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Space Administration



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**Communications, Navigation, and Networking reConfigurable Testbed
(CoNeCT) Project**

National Aeronautics and Space Administration
John H. Glenn Research Center at Lewis Field, OH 44135

CoNeCT PROJECT

CONFIGURATION MANAGEMENT PLAN (CMP)

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PREFACE

National Aeronautics and Space Administration (NASA) is developing an on-orbit, adaptable, Software Defined Radios (SDR)/Space Telecommunications Radio System (STRS)-based testbed facility to conduct a suite of experiments to advance technologies, reduce risk, and enable future mission capabilities on the International Space Station (ISS). The Communications, Navigation, and Networking reConfigurable Testbed (CoNNeCT) Project will provide NASA, industry, other Government agencies, and academic partners the opportunity to develop and field communications, navigation, and networking technologies in the laboratory and space environment based on reconfigurable, software defined radio platforms and the STRS Architecture. The CoNNeCT Payload Operations Nomenclature is “SCAN Testbed” and this nomenclature will be used in all ISS integration, safety, verification, and operations documentation. Also included are the required support efforts for Mission Integration and Operations, consisting of a ground system and the Glenn Telescience Support Center (GRC TSC). This document has been prepared in accordance with NASA Glenn’s Configuration Management Procedural Requirements GLPR 8040.1 and applies to the CoNNeCT configuration management activities performed at NASA’s Glenn Research Center (GRC). This document is consistent with the requirements of SSP 41170, Configuration Management Requirements, International Space Station, and Space Assurance and Requirements Guideline (SARG).

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Preliminary	DRAFT 1	08/20/2009	Update to latest Preface/org chart. Redefine the CCB. Incorporate verbal comments/recommendations from Manufacturing. Reference author legacy revision PREL 6.1.
Baseline	–	08/31/2009	Initial baseline release. (Updated to latest org chart. Redefine the CCB responsibilities. Incorporate written comments/recommendations from CCB. Reference author legacy revision PREL 7.1.)
Revision	A	02/05/2010	Update Baseline release to incorporate RID 039 Comments, CONN-CR-0018, and CONN-CR-0021. Update CM processes.
Revision	B	03/26/2012	Update document to better reflect present operation. Update required signatures for Drawings, Documents and RDWs. Incorporate Change Request CONN-CR-0559.

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1.0 INTRODUCTION

The Communications, Navigation, and Networking reconfigurable Testbed (CoNNeCT) project is a technology demonstration flight for the Software Defined Radio (SDR) and other technologies being developed as part of the Space Telecommunications Radio Systems (STRS) project sponsored by the Space Communications and Navigation (SCaN) Program Office within Space Operations Mission Directorate (SOMD). GRC has been assigned leadership for the project.

The Communications, Navigation, and Networking reconfigurable Test-bed (CoNNeCT) will provide an on-orbit, adaptable, SDR/STRS-based facility on the International Space Station (ISS) to conduct a suite of experiments to reduce risk and enable future mission capability.

The CoNNeCT Project will provide NASA, industry, other Government agencies, and academic partners the opportunity to develop and field communications, navigation, and networking technologies in the laboratory and space environment based on reconfigurable, software defined radio platforms and the Space Telecommunications Radio System (STRS) Architecture.

1.1 Purpose

The purpose of this plan is to describe the policy and procedures for Configuration Management. The Configuration Management Plan is established to provide the necessary instructions to ensure that proper controls are implemented to receive, store/archive, reproduce, and distribute all related Ground Support Equipment (GSE), Ground Flight Systems (GFS), and Flight hardware and documentation. Adherence to the guidelines defined in this plan ensures that all Configuration Items (CI's) will be protected from unauthorized change, and ensures that the integrity of the design is maintained at all stages of development, build, test, integration, and operations. This plan covers Configuration Management, Data Management, and Change Control for the CoNNeCT Project. The CoNNeCT Configuration Management Plan (CMP) sets forth the requirements, responsibilities, and procedures required to maintain systematic control of Project documentation and guidelines. This CMP describes the methodology used to facilitate the CoNNeCT Project Configuration Management (CM) activities.

1.2 Scope

This plan applies to all participating project team members and supporting contractors at all NASA centers supporting the Project. The CoNNeCT project team and all organizational interfaces will utilize the methodology described in this CMP. This CMP describes which CM disciplines will be employed during the CoNNeCT product life cycle. The CM principles described in this document will be applied to all hardware and documentation products that apply to the design, manufacture and test of the CoNNeCT GSE, GIU and Flight hardware, (subsequently referred to as “products”) and as identified in the CoNNeCT Documentation Tree, GRC-CONN-TREE-0020, and the drawing trees. The configuration management of software is defined in a separate “Software Configuration Management Plan”, GRC-CONN-PLAN-0001.

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2.0 APPLICABLE DOCUMENTS

This section lists the NASA/Government and non-NASA/Government specifications, standards, guidelines, handbooks, or other special publications applicable to the application of this document.

2.1 Applicable Documents

Applicable documents are those documents that form a part of this document. These documents carry the same weight as if they were stated within the body of this document.

Document Number	Applicable Document
	GRC Engineering Development Division Drafting Standards & Guidelines Date Issued: October 1, 2004
GLPR 8040.1	Configuration Management, Glenn Procedural Requirements
GRC-CONN-PLAN-0001	CoNNeCT Software Configuration Management Plan (SCMP)
GRC-CONN-PLAN-0004	CoNNeCT Project Plan
GRC-CONN-PLAN-0005	CoNNeCT Systems Engineering Management Plan
GRC-CONN-PLAN-0006	CoNNeCT Product Assurance Plan (PAP)
GRC-CONN-TREE-0020	CoNNeCT Documentation Tree
MIL-STD-130	Marking
NPD 1440.6	NASA Records Management
NPD 2190.1	NASA Export Control Program
NPD 2200.1	Management of NASA Scientific and Technical Information (STI)
NPD 2810.1	NASA Information Security Policy
NPR 1441.1	NASA Records Retention Schedules (NRRS)
NPR 1600.1	NASA Security Program Procedural Requirements
NPR 2190.1	NASA Export Control Program
NPR 2810.1	Security of Information Technology
NPR 7120.5	NASA Space Flight Program and Project Management Requirements
SARG	Space Assurance and Requirements Guideline
SSP 41170	International Space Station (ISS)Program Configuration Management Requirements

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2.2 Reference Documents

Reference documents are those documents that, though not a part of this document, serve to clarify the intent and contents of this document.

Document Number	Reference Document
ANSI/EIA-649	National Consensus Standard for Configuration Management
ANSI/IEEE Std 1042-198	IEEE Guide to Software Configuration Management
ASME Y14.5M-1994	Dimensioning & Tolerance
ASME Y-14-2000	Engineering Drawing Practices
EIA 649	National Consensus Standard for Configuration Management
ISO 9000	Quality Systems, Model for Quality Assurance in Design, Development and Equipment Certification
ISO-9001	Quality Management Requirements
ISO 10007	Quality Management – Guidelines for Configuration Management
ISO 12207	Information Technology – Software Life Cycle
MIL-DTL-31000	Technical Data Packages, General Specification For
MIL-HDBK 61A	Configuration Management Guidance
MIL-STD-12	Abbreviations for use on Drawings, and in Specifications, Standard and Technical Documents
MIL-STD-100	Engineering Drawing Practice
NASA-STD-2100-91	NASA Software Documentation Standard
SSP 30695	Acceptance Data Package Requirements Specification
SSP 50007	Space Station Inventory Management System Label Specification
SSP 50123	ISS Configuration Management Handbook

2.3 Order of Precedence for Documents

In the event of a conflict between this document and other documents specified herein, the requirements of this document shall apply. In the event of a conflict between this document and higher level documents, the higher level documents shall take precedence over this document.

All documents used, applicable or reference, are to be the approved versions released as of the contract start date. All document changes issued after contract baseline establishment shall be reviewed for impact on scope of work. Nothing in this document supersedes applicable laws and regulations unless a specific exemption has been obtained.

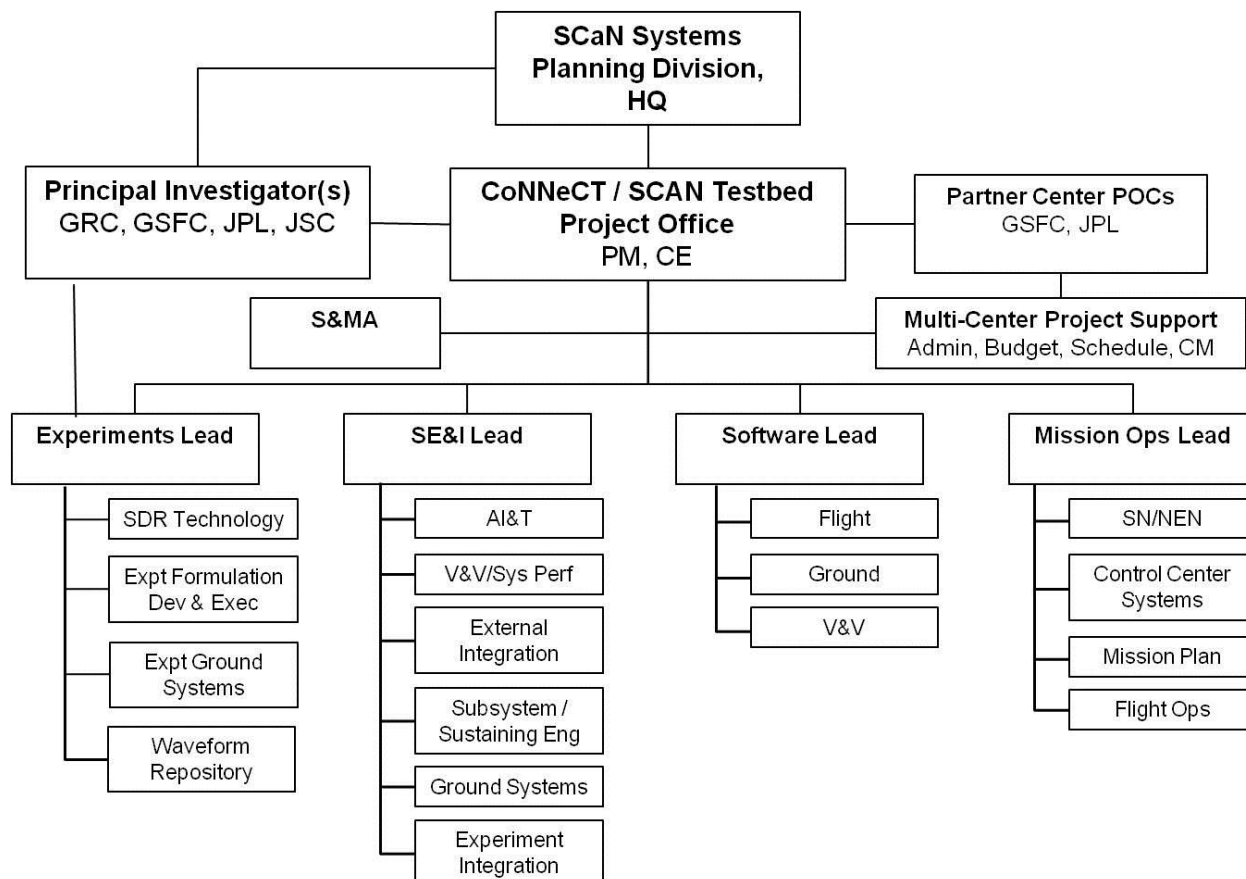
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3.0 ORGANIZATION, ROLES, RESPONSIBILITIES, AND RESOURCES

3.1 Project Organizational Structure, Roles, Responsibilities and Resources

Figure 3-1 identifies a graphical representation of the CoNNeCT project organizational structure. Project Management is responsible for the decisions, actions, and directions necessary to ensure that the CM system fulfills the project requirements. CM activities are provided by ZIN Technologies under the Space Development and Operations Contract (SpaceDOC) Delivery Order 128 (DO-128). ZIN Technologies is responsible for implementing and maintaining this CM Plan. Resource levels necessary to implement this CM Plan will be maintained commensurate with the CoNNeCT project phase and workload as determined by the NASA CoNNeCT Project manager and the ZIN CoNNeCT Project Lead. The CoNNeCT project CM organizational structure is provided in Section 3.2. The overall roles, responsibilities, and resource requirements for the CoNNeCT Project are defined in the CoNNeCT Project Plan (GRC-CONN-PLAN-0004).

Figure 3-1—CoNNeCT Project Organizational Structure



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3.2 Configuration Management (CM) Organizational Structure, Roles, and Responsibilities

The CoNNeCT Configuration Management Lead (CML) communicates CM activities with the various developers and elements of the CoNNeCT Project. The CML develops and maintains the CM related plans, policies, and procedures required by the CoNNeCT Project Office. The Configuration Management Analysis (CMA) assists the CML with the development and maintenance of the Configuration Status Accounting (CSA) using the Configuration Management Tracking System (CMTS) and ensures that the information is accurate and updated as changes occur.

The Software Configuration Items and the configuration management methodology applied will be identified in a separate CoNNeCT Software Configuration Management Plan (GRC-CONN-PLAN-0001).

The Configuration Management Lead's (CML) responsibilities for the CoNNeCT project include the following items.

3.2.1 Configuration Control

- Prepare and implement the CM Plan
- Determine, create and maintain operating procedures and controls to define:
 - Which CM principles are applied
 - How they are implemented
 - How they are verified
- Coordinate the CRB activities to ensure the appropriate reviews and approvals are implemented on the CoNNeCT program

The Configuration Management Analyst (CMA) assists the CM Lead in the following responsibilities for the CoNNeCT project.

3.2.2 CM Identification

- Ensure proper hardware and software document and drawing identification
 - Assign configuration identification numbers for all project configuration items (CIs)
 - Verify proper identification, product configuration, change history and methods
 - Define product attributes as a basis for acquisition and use of the product.
 - Label product configuration items to ensure traceability throughout the product life cycle
 - Define Manufacturing and procurement documentation required
 - Create and publish logs and reports
- Receive, format and process for review all deliverable documents
 - Ensure document authors receive all review comments submitted by reviewers.

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3.2.3 Change Management

- Administer change control activities and support the Change Review Board (CRB):
 - Manage change activities using an approved change control process for all product configuration items and baselines
 - Assign change request numbers (CR)
 - Coordinate and schedule meetings for CoNNeCT Change Review Board (CRB) for team member's review, discussion and approval signoff of all new and revised manufacturing documentation including documents, drawings, process plans, CRs, RDWs, etc.
 - Distribute all change requests to CRB board members for review, impact, and disposition
 - Coordinate the review and approval of all change requests and RDWs.
 - Review all change requests and evaluate proposed changes for impact prior to change disposition
 - Ensure that changes are approved, formally distributed for hardware implementation and document/drawing incorporation, and recorded for all controlled products

3.2.4 Status Accounting

- Establish the CM release system
- Establish and maintain the configuration status accounting (CSA) system
 - Create and secure the CM database to ensure integrity of the baseline
 - Record and enter data into the CM database
 - Create, maintain and publish the document status listing
 - Identify, track, record and report changes made to product baselines
 - Maintain effective controls and tracking of latest revision for all documentation as provided to CM for Data Management.

3.2.5 Data Management

- Create project repositories and libraries for all project configuration data
 - Control, maintain, store and archive configuration related data
 - Establish a secure repository for the vaulting of:
 - Hardware and software documents and drawings
 - Change requests
 - Request for Deviations and Waivers (RDWs)
 - Manufacturing Process Plans
 - Connect Project Directives
 - As-Built Lists (ABL)
 - Acceptance Data Packages (ADP)
 - Additional supporting manufacturing documentation
 - Supporting Verification and Validation documentation
 - Hardware/software acceptance and test documentation
 - Applicable Contract Data Requirements Deliverables (CDRLs)

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- Coordinate publication and collaboration of documentation and changes
 - Organize CM data to facilitate ease of access and retrieval for:
 - Project team members' and management's decision making process
 - Procurement and manufacturing processes
 - Assist in establishing and maintaining the CoNNeCT team collaboration documentation in the eRoom.
 - Establish and maintain folders in the eRoom for the review and collaboration of preliminary project documentation not yet under formal CM control

3.2.6 Verification and Audit

- Maintain and track CM related data requirements, actions and CM change documentation resulting from the corrective actions needed to close Non-Conformance Report (NCRs).
- Conduct audits and reviews of CoNNeCT products and processes
 - Manufacturing processes and documentation
 - Procurement processes and documentation
 - Subcontractor process audits
- Functional configuration audits (as required)
- Physical configuration audits (as required)
- Integrated baseline reviews (as required)
- As-built lists
- Acceptance data packages
- Support various reviews (Requirements Readiness, Preliminary Design, Critical Design, Flight Readiness, etc.)

3.3 CoNNeCT Team Member Roles and Responsibilities

Configuration Management is responsible for implementing the CoNNeCT functions detailed below through direct actions and by coordinating efforts between functional support departments within the project and NASA. The following is a brief overview of the various functions' roles and responsibilities as they pertain to CM.

3.3.1 CoNNeCT SCan Testbed Project Manager

- Serve as the CoNNeCT Control Board (CCB) Chair
- Charter the CCB (refer to the Project Plan, GRC-CONN-PLAN-0004 for charter specifics)
- Charter the CRB for the review and approval of documentation
- Direct baseline establishment
- Issue necessary Project Directives
- Approve and direct CM policies for the Project

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3.3.2 Chief Engineer

- Serve as the Engineering Review Board (ERB) Chair
- Review applicable project documents
- Serve as a participating member of the CCB
- Serve as the CoNNeCT technical interface to higher level NASA CCB's
- Support the CRB ad-hoc

3.3.3 Principal Investigator

- Review applicable project documents
- Serve as a participating member of the CCB
- Serve as the CoNNeCT technical interface to the major partners on the communication packages
- Support the CRB ad-hoc

3.3.4 Safety and Mission Assurance

- Ensure all project activities comply with applicable safety, reliability, maintainability, quality standards and documents
- Review all CRs and RDWs, and applicable project documentation and drawings
- Verify proper incorporation of all configuration changes
- Support the review, inspection, and sign-off of hardware deliveries, including all applicable formal and informal configuration audits
- Serve as the Material Review Board (MRB) Chair
- Serve as a participating member of the CCB
- Serve as a participating member of the ERB
- Serve as a participating member of the CRB

3.3.5 Systems Engineering and Integration Lead

- Review engineering changes to ensure conformance to the technical requirements of the project and all interfaces are maintained
 - Internal as well as external (HTV, ISS, ELC, etc.)
- Responsible for all systems-level drawings, assembly procedures, and test documentation
- Serve as a participating member of the CCB
- Support the ERB and MRB ad-hoc
- Serve as a participating member of the CRB

3.3.6 Software Lead

- Serve as a participating member of the CCB
- Review engineering changes for impact to the CoNNeCT software
- Responsible for all CoNNeCT software and software related activities (refer to the CoNNeCT Software Configuration Management Plan, GRC-CONN-PLAN-0001 for an in depth account regarding Software Configuration Management)

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3.3.7 Subsystem Engineering Leads

- Review all applicable drawings and documents
- Serve as a focal point for receipt and review of engineering changes submitted for disposition
- Identify and coordinate all impacts on the applicable hardware with respect to in-progress or completed parts and assemblies
- Determine coordination efforts for expedited incorporation of changes as well as modification of hardware requiring CR incorporation
- Support ERB and MRB activities as applicable to their function
- Support the CRB ad-hoc
- Submit Engineering Process Instructions and Procedures, CRs, RDWs and NRCs to CM for processing and implementation of corrective actions
- Support Quality Assurance during inventory acceptance to ensure that all hardware is inspected and identified properly prior to being logged into the Bonded Stockroom
 - Ensure that complete sets of paperwork, as defined on a Purchase Order, are received with the hardware (including C of C) prior to acceptance into the Bonded Stockroom
- Establish and maintain control of all flight hardware issued for assembly and test
 - Ensure that manufacturing logbooks and history sheets are maintained
 - Ensure hardware tracking information is recorded into the manufacturing database system
 - Ensure traceability records are maintained to insure where-used data is recorded for every piece of hardware issued and installed in GFS, GSE and Flight hardware

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3.3.8 Designers/Drafters

- Process completed, checked, and engineering approved drawings into CM release system
- Incorporate approved CRs onto the drawing and put into cycle for CR initiator's review and verification of proper incorporation
- Provide CM copies of initial released drawings and all future approved revised drawings (Electronic versions and hardcopies as applicable)
 - All approved CM released drawings will be PDF's and located in the CoNNeCT eRoom. PDF files of all drawings will be stored in CM's Configuration Management Tracking System (CMTS). Mechanical ProE drawings files will be maintained in Windchill system by the designated designer. Electrical AutoCAD drawing files will be stored in CMTS along with a PDF version.
 - Signed hardcopies of all released documentation will be retained in the CoNNeCT CM Library
 - Support the CRB – ad-hoc

3.3.9 Deputy for Resources

- Support the CCB as a non-voting member
- Participate in the review and approval of all resource related changes presented to, and approved by, the CCB via the CoNNeCT Directive Form
- Arrange for necessary resource funding required due to an approved configuration change

3.3.10 All CoNNeCT Project Members

- Identify any item that requires reporting due to a non-conformance, and/or failure, and/or problem
- Identify any documentation or process viewed as deficient and requiring review by generating an NCR, CR, or RDW, as appropriate
- Ensure that Logbooks and History Sheets are maintained
- Abide by the established Configuration Management Plan, policies, and procedures
- Support the CRB ad-hoc

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3.3.11 Change Review Board

- The Change Review Board (CRB) is comprised of CoNNeCT team members, depending on the specific document, for the task of reviewing and approving manufacturing documentation.
- Members of the CRB are Designers, Responsible Engineer, S & MA / Quality, System Engineering, Structural Analysis, Thermal Analysis, Avionics, Mechanical, Configuration Management, Manufacturing, (Fracture Critical / Safety Critical Rep as required), and others as needed to adequately assess the change.
- Support the review, discussion and approval signoff of all new and revised manufacturing documentation including documents, drawings, process plans, CRs, RDWs, etc.

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3.4 Configuration Management Activities

The CM methodology described in this document is in accordance with the EIA-649, “National Consensus Standard for Configuration Management”, and GLPR 8040-1, “Configuration Management for GRC Programs/Projects”. The intent of this document is to define the CM activities (Fig. 3.2) necessary to facilitate the systematic management and control of CoNNeCT products, product information, and product changes.

Software Configuration Items and the configuration management methodology applied will be identified in a separate CoNNeCT Software Configuration Management Plan (GRC-CONN-PLAN-0001).

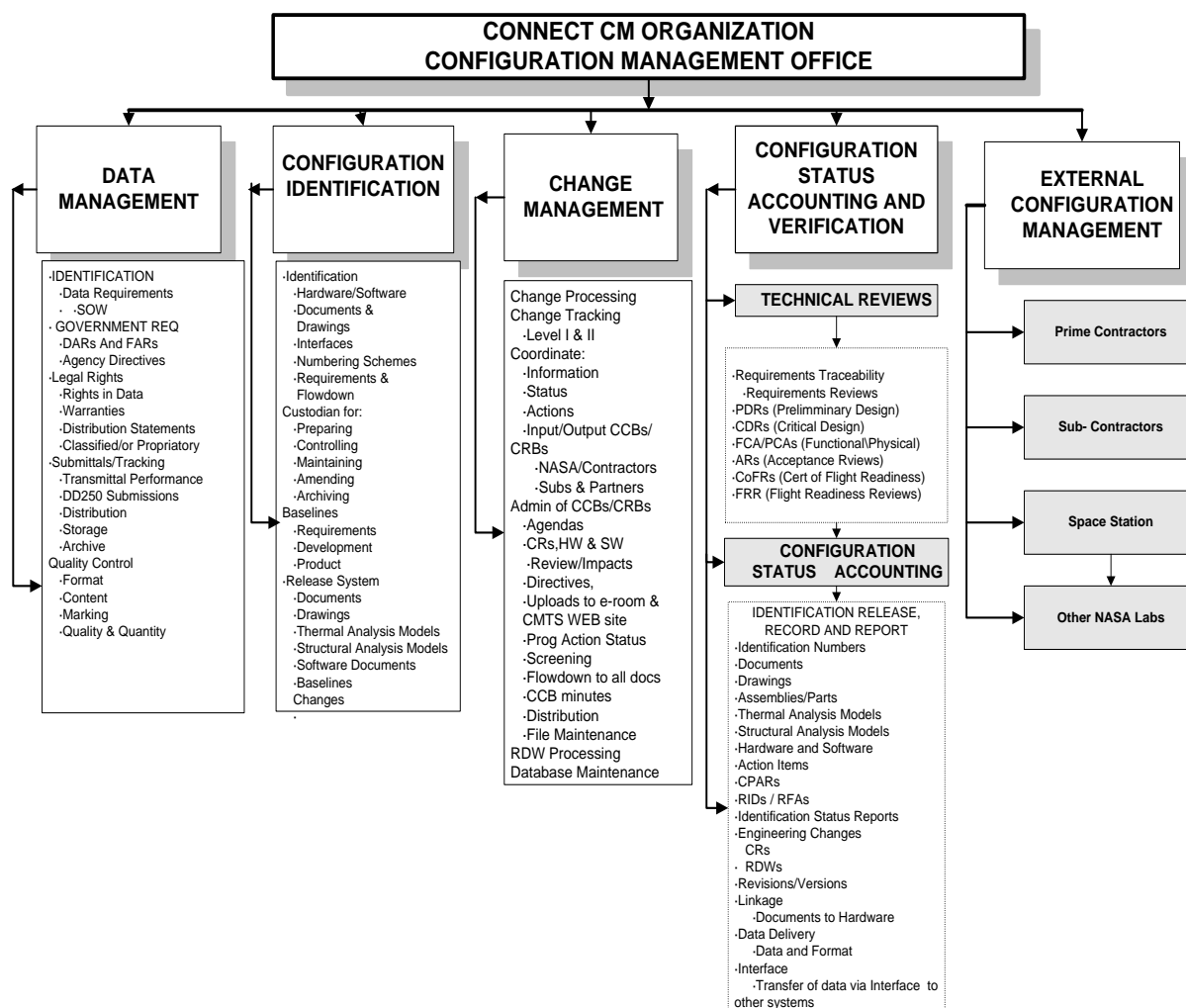


Figure 3-2—Configuration Management Activities

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3.5 Document Initiation and Acceptance Process

All documents shall be processed for review and release through the CM system as identified in Figure 3-3. The CoNNeCT eRoom Inspection folder will be used for the distribution, review, and disposition of comments on in-process documents distributed for review prior to approval and formal CM release. All approved CM released documents will be PDF'd and located along with the Word and Excel document's native files in CM's Configuration Management Tracking System (CMTS). Folders shall be divided into sections for review, baseline, non-baseline, and CoNNeCT Project information documents. Baseline reports shall be posted for identification of the present CM approved and released configuration of all hardware baselines.

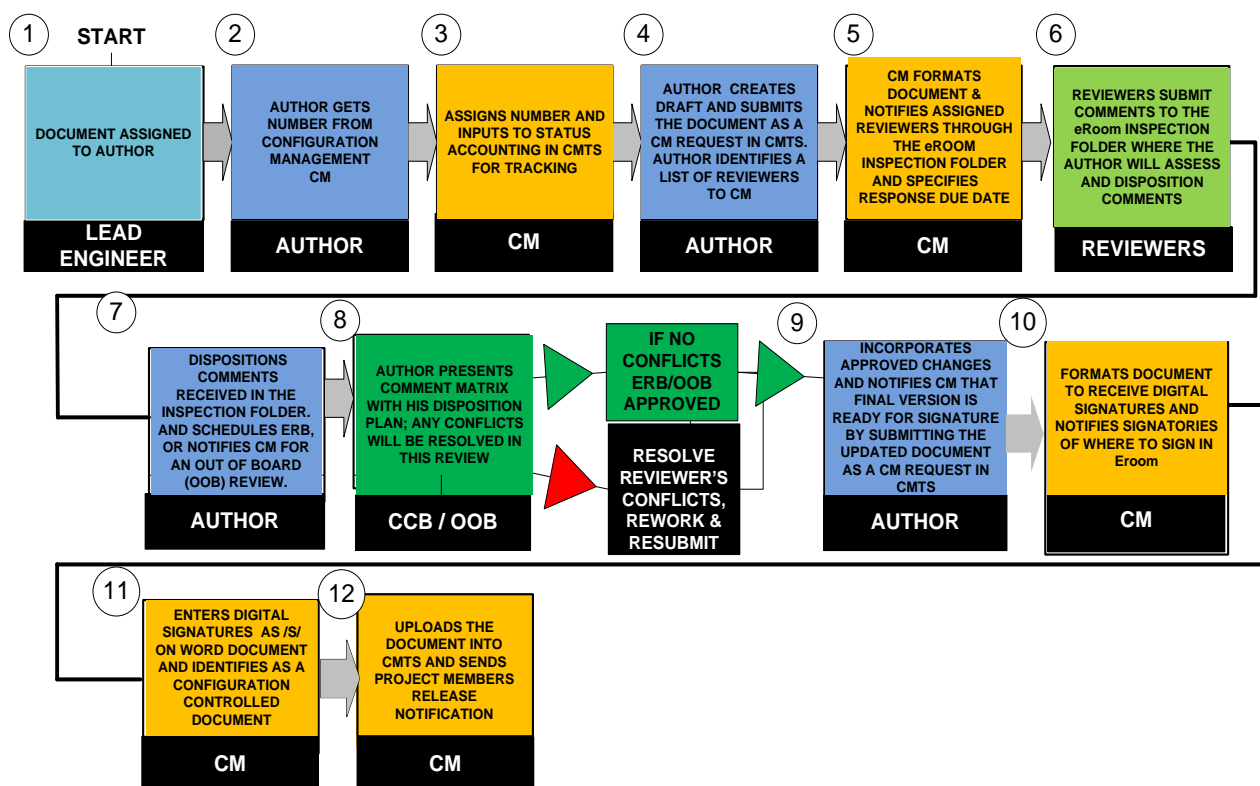


Figure 3-3—CoNNeCT Document Review and Acceptance Process

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3.6 Drawings Initiation and Acceptance Process

All drawings shall be processed for review and release through the CM system as identified in Figure 3-4. The CM Team will coordinate the distribution, review, and disposition of comments on in-process drawings distributed for review prior to approval and formal CM release. All approved CM released drawings will be PDF's and located in the CMTS for the teams retrieval. Mechanical ProE drawings files will be maintained in Windchill system by the designated designer. Electrical AutoCAD drawing files will be stored in CMTS along with a PDF version.

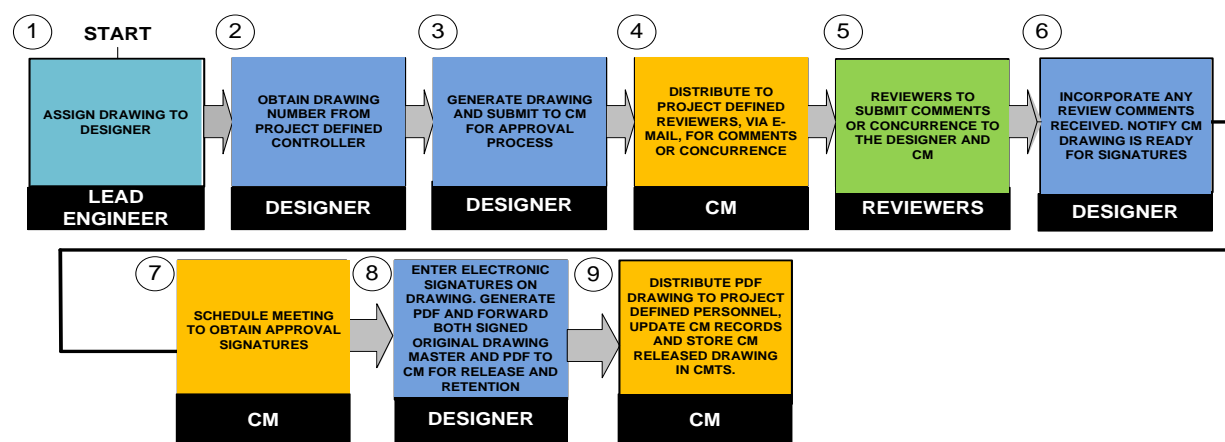


Figure 3-4—CoNNeCT Drawing Review and Acceptance Process

3.7 CM Document Release Systems

Data Requirements and Data Requirements Documents from the Contractor and Sub-contractors will be processed through the CM release as identified in Figure 3-5.

After a document has completed the final review, and all comments are incorporated, CM will route for approval signatures. Upon obtaining all approval signatures, CM will enter signatures electronically and identify the document as a configured controlled document by signing the cover sheet indicating CM release. CM will upload the document into the eRoom and send release notification to the project members. The signed hard copy will be stored in CM's files and the electronic version will be uploaded into CMTS.

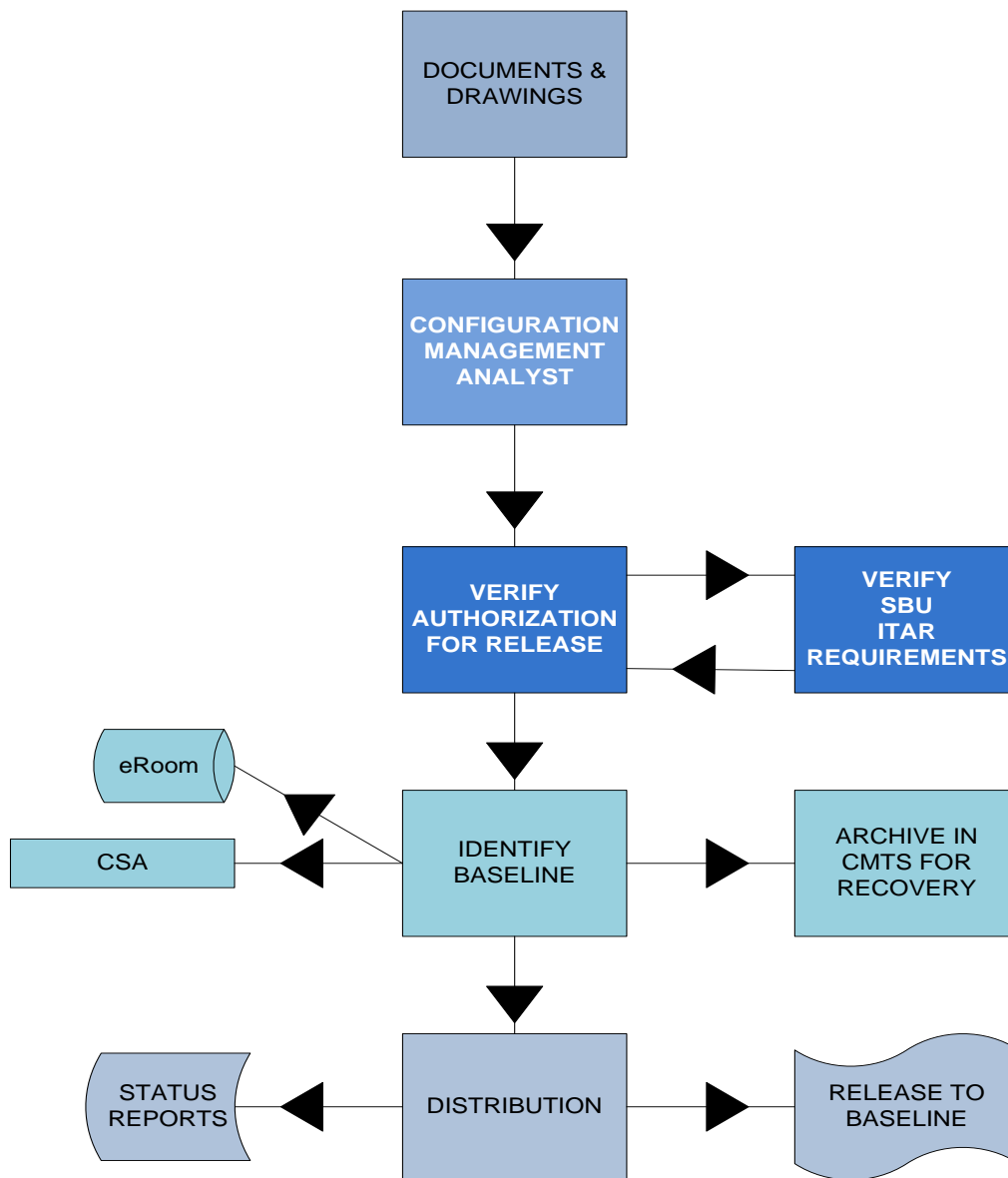


Figure 3-5—CM Release System

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4.0 CONFIGURATION IDENTIFICATION

Configuration Identification is the basis, from which the configurations of products are identified, defined, verified, and tracked. Products are labeled, changes are managed, and accountability is maintained through the Configuration Identification process. A Configuration Item (CI) is an aggregation of hardware and/or software and deliverable items, or any of its portions that satisfies an end use function and is designated for configuration management and control. Configuration identification includes the selection of CIs and determining the types of configuration documentation required for each CI. The issuing of numbers affixed to the CIs and to the technical documentation that defines the CI's configuration. This would include internal and external interfaces, the release of CIs and their associated configuration documentation and the establishment of configuration baselines for CIs. The Configuration Identification activities will be in accordance with NASA Glenn Research Center, International Organization for Standardization (ISO) procedure, GLPR 8040-1 Programs/Projects" to facilitate product traceability guidelines. The following tasks are associated with the identification activity and are implemented by the CoNNeCT CMA after the project team identifies and defines the configuration items:

- Numbering scheme for all documents, drawings and products.
- Identification of the hardware and software documentation hierarchy.
- Selection and labelling of the Configuration Items (CIs) to be developed and/or controlled.
- Numbering assignments for documents shall be accomplished by the CMA through the CMTS and published on the CoNNeCT eRoom.

4.1 Selection of the Configuration Items and Numbering

Project documents will be numbered using the standard format of Program documents controlled by the CMA Release Desk. The document numbering scheme is identified in Figure 4-1. Documents received from contractors or other outside sources that are already numbered will retain their original number. Upon receipt of a document or the initiation of a document in-house, the release desk will assign a document number. All project team members will obtain document numbers from the CMA release desk.

4.2 Establishing the Documentation Hierarchy

The documentation hierarchy provides a structural view of the system and its elements. This hierarchy is the basis for the selection of the CIs to be tracked and establishment of a numbering scheme for CoNNeCT products. The Project Chief Engineer and Lead Systems Engineering are responsible for establishing a Documentation Tree and providing it to the Configuration Management Analyst (CMA).

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4.3 Document Identification and Numbering Scheme

The Document numbering scheme for CoNNeCT documents is identified in Figure 4-1. The Configuration Management Analyst is responsible for assigning all numbers used on the CoNNeCT project. These numbers will be assigned in sequential order as they are received from the authors and processed through the CM Analyst for Release, Status Accounting, and Archived and uploaded to the eRoom and store in the Configuration Management Tracking System. If the document type does not exist the CMA will evaluate the need to assign a new document type, and as required, update the list shown in Figure 4-1 of this CM Plan.

**NOTE: CONFIGURATION MANAGEMENT SHALL ASSIGN ALL
DOCUMENT NUMBERS**

4.4 Sensitive But Unclassified (SBU) Documentation

Some documents on the CoNNeCT project require special handling due to the sensitive nature of the content. These documents will be classified as Sensitive But Unclassified (SBU). Any such documentation shall be labeled with a SBU cover sheet as well as a stamp on each page indicating SBU classification. SBU documentation shall be stored in folders on eRoom where only people with approved access can view. eRoom access is controlled by requiring prior approval to receive a Key Fob access to the site and by assigning specific roles to each member that provides restricted access to certain folders within the site.

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GRC	CONN	DOCUMENT TYPE	SEQUENTIAL NUMBER
Glenn Research Center	Project Identifier (CoNNeCT)	See figure below for acronyms	All numbers will be assigned in sequence, starting with 0001

DOCUMENT TYPES		
<p>EXAMPLES</p> <p>GRC-CONN-PLAN-0001 GRC-CONN-ICD-0002 GRC-CONN-TEST-0003 GRC-CONN-ABL-0004</p>	ABL	AS-BUILT LIST
	ADP	ACCEPTANCE DATA PACKAGE
	ALIG	ALIGNMENT PROCEDURE
	ANA	ANALYSIS DOCUMENT
	APR	ASSEMBLY PROCEDURE
	BCD	BASELINE CONCEPT DOCUMENT
	BDD	Baseline Design Description
	BSD	BASELINE SYSTEM DOCUMENT
	CIL	CONFIGURATION ITEM LIST
	CPAR	CORRECTIVE AND PREVENTIVE ACTION REPORTING
	DBK	DATABOOK
	DOC	DOCUMENT
	ECM	EXPERIMENT COMPLIANCE MATRIX
	EET	END TO END TEST
	ICD	INTERFACE CONTROL DOCUMENT
	INST	INSPECTION PROCEDURE
	INTG	INTEGRATION PROCEDURE
	LIST	LISTING
	MATE	MATING PROCEDURES
	MEMO	MEMO
	MOD	MODIFICATION PROCEDURE
	MUA	MATERIAL USAGE AGREEMENT
	OPI	OPERATING INSTRUCTIONS
	OPS	OPERATING PROCEDURE
	PLAN	PLAN
	PPL	PREFERRED PARTS LIST
	PRO	PROCEDURE
	PROP	PROCESS PLAN
	RCM	REQUIREMENTS COMPLIANCE DOCUMENT
	REQ	REQUIREMENTS DOCUMENT
	RPT	REPORT
	SRD	SYSTEM REQUIREMENTS DOCUMENT
	SCD	SPECIFICATION CONTROL DOCUMENT
	SCHL	SCHEDULE
	SDP	SAFETY DATA PACKAGE
	SOFT	SOFTWARE DESIGN DOCUMENT
	SPEC	SPECIFICATION
	TEST	TEST PROCEDURE
	TREE	TREE
	VDD	VERSION DESCRIPTION DOCUMENT
	VRR	VERIFICATION REPORT
	WI	WORK INSTRUCTIONS

Figure 4-1—CoNNeCT Document Numbering Scheme

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4.5 Document Signature Requirements

The signatures required for the review, release and updating of controlled documents are shown in Table 4-1, identified by designated type. Any specialty function may also be required to review and sign at the request of the Chief Engineer, Quality Assurance or the Project Manager. Configuration Management will sign the cover sheet indicating CM release.

Baselined documents shall be signed by the same functions as those that signed the original released document.

4.6 Drawing Numbering Scheme

Drawing part and drawing number schemes for the mechanical and electrical drawings developed at GRC, for the CoNNeCT configuration, shall be assigned new document numbers as new requirements are identified. Drawing and part identification numbers for hardware shall be established in accordance with ASME Y-14-2000 "Engineering Drawing Practices" and the "GRC Engineering Development Division Drafting Standards & Guidelines Date Issued: October 1, 2004". Drawing numbers shall be developed in accordance to the scheme defined in Table 4-2. All assembly drawings shall have a parts list for any part with two or more components.

Table 4-1—CoNNeCT Document Sign-Off Requirements

Document Type	Required Signatures
Acceptance Data Package (ADP)	Author S & MA Lead WBS Lead Chief Engineer (System Level 3 Only) Project Manager (System Level 3 Only)
Assembly Procedure	Author Manufacturing S & MA WBS 5.0 Lead
Plans (Programmatic)	Author WBS Lead(s), as applicable Chief Engineer Project Manager
Plans (Test)	Author Test Lead WBS Lead S & MA Program Manager (System Level 3 Only)
Procedures - (Tests), Inspections, Demonstrations	Author S & MA SE & I Lead (System Level 3 Only) AI & T Lead (Tests or Demonstration on Flight System Only) WBS Lead PI (Radios Only)

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Document Type	Required Signatures
Process Plans	Manufacturing (Author) Avionics Lead (or) Mechanical Lead S & MA CM
Reports (Level 3 Analysis)	Author WBS Leads DLE
Reports (Tests)	Author WBS Leads DLE
Safety Data Package	Author S & MA Lead Code Q Team Lead (DLE) Independent Safety Review Project Manager
Subsystem Requirements, Including ICDs	Author Subsystem Lead WBS Lead Project Manager
System Level Requirements	Author All WBS Leads PI Chief Engineer Project Manager
Trees, Lists, Miscellaneous	Author WBS Lead CM
Verification Closure Notice (Check V&V Plan)	Author Responsible Engineer V & V Lead
Work Instructions	Author Manufacturing AI & T Lead

CM is signatory on all documents

Signatures can be tailored as necessary, though only a single author is permitted.

WBS Lead is generally the WBS Lead of the Author. Additional WBS Leads, if relevant, may be included at the author's discretion, though the goal is to minimize the number of signatories.

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Table 4-2—CoNNeCT Drawing Numbering Scheme

Drawing Number Example: 080911MRA001

Hardware/drawing numbering convention:

XXXXXX X X X XXX

Project Code | Discipline | Fidelity | Type | Part/Assembly Number

Identifier Code Number represents the specific Project Code Number

The project code is a six-character group (080911) that uniquely identifies a project.

The discipline will be indicated using one character as follows:

- (1) M-Mechanical Drawings
- (2) E-Electrical Drawings
- (3) P-Piping Drawings
- (4) S-Structural Drawings
- (5) F-Facilities Drawings

The fidelity will be indicated using one character as follows:

- (1) E-Engineering Model
- (2) F-Flight
- (3) G-Ground Support Equipment (GSE)
- (4) M-Mockup

The type code will be indicated using one character as follows:

- (1) Mechanical, facilities, or structural:
 - (a) A-Assembly
 - (b) B, C-Unassigned letters
 - (c) D-Detail
 - (d) T-Tree
- (2) Electrical & Systems:
 - (a) A-Assembly
 - (b) B-Block diagrams
 - (c) Connection diagrams (Control Interconnect Systems)
 - (d) D-Detail
 - (e) E-Elementary
 - (f) F-Flow schematic
 - (g) I-Instrumentation
 - (h) L-Layouts / Artwork
 - (i) M-Miscellaneous
 - (j) K-Composite
 - (k) S-Schematic
 - (l) T-Tree
- (3) Piping:
 - (a) A-Assembly
 - (b) I-Installation drawings
 - (c) S-Flow schematic
 - (d) D-Detail

The part/assembly number will be indicated by using three-character numbers as follows:

- (1) Numbering will begin at "001" and implemented sequentially.

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The signatures identified in Table 4-3 and Table 4-4 are the mandatory signatures required for the release of drawings. Any specialty engineering function may also be required to review and sign at the request of the Lead Engineer or Quality Assurance representative. Fracture and Safety functions will sign those drawings that are designated as fracture and safety critical.

Table 4-3—Mechanical Drawing Signature Requirements

PROJECT ROLE	Flight Mechanical Drawings		
	ASSEMBLY DRAWINGS	DETAIL DRAWINGS	SPECIFICATION CONTROL DWGS
Designer	X	X	X
Responsible Engineer	X	X	X
S&MA /Quality	X	X	X
System Engineer	X	X	X
Structural Analysis	X	X	X
Thermal Analysis	X	X	X
Fracture Critical Rep (As Required)		X	X
Safety Critical Rep (As Required)		X	X
Configuration Management	X	X	X

Table 4-4—Electrical Drawing Signature Requirements

PROJECT ROLE	Flight Electrical Drawings			
	ASSEMBLY DRAWINGS	DETAIL DRAWINGS	SCHEMATICS ELECTRICAL	SPECIFICATION CONTROL DWGS
Systems Engineer	X	X	X	X
Mechanical (PWB's)	X			X
Avionics	X	X	X	X
S&MA / Quality	X	X	X	X
Systems	X	X	X	X
Configuration Management	X	X	X	X

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4.7 Subcontractor and Partner Drawings

All drawings provided by CoNNeCT subcontractors and Partners as defined as deliverables in the subcontractor's Statement of Work (SOW) and the Partner's Memo of Agreement (MOA), will be PDF'd and uploaded into the CoNNeCT eRoom and stored in the CMTS Library as they become released and identified by drawing number, revision status and title.

4.8 Data Requirements Document (DRD) Deliverables

All Subcontractor and Partner generated documents received will be processed in accordance with the following sections. These sections will cover how Data Management (DM) will be applied to DRD deliverables (Specifications and Interface Control Documents [ICDs]). Data types 1 and 2 (described in the next section) will be formally reviewed and approved by the CCB. Data Type 3 (defined as data delivered by the subcontractors and Partners, but not requiring GRC approval) will be reviewed by the Office of Primary Responsibility (OPR)/Lead to assure that the document satisfies applicable contractual requirements. A CoNNeCT Comment Review form will be initiated for comments for all Type 1 and 2 documents, or when a Type 3 document does not meet the Contractual Requirements.

4.8.1 Data Types

Data are defined into specific types that rank in order with the degree of review and approval required between GRC the subcontractors and the Partners. The following defines the principal types of data that may be involved in the CoNNeCT project's data management.

4.8.1.1 Type 1 Data

All issues and interim changes to those issues that require written approval from the requiring organization before formal release for use or implementation. Subsequent to the CoNNeCT CCB authorization, the contractor will be provided formal disposition of the document through the contracting officer.

4.8.1.2 Type 2 Data

GRC's CoNNeCT Program Management reserves a time-limited right to disapprove in writing any issues and interim changes to those issues. Data is submitted to the procuring activity for review not less than 45 calendar days prior to its release for use or implementation. The contractor shall clearly identify the release target date in the "submitted for review" transmittal. If the contractor has not been notified of any disapproval prior to the release target date, the data shall be considered approved. To be an acceptable delivery, disapproved data shall be revised to remove causes for the disapproval before release. The CoNNeCT CCB's disposition will normally serve as the basis for the contracting officer's direction.

4.8.1.3 Type 3 Data

This type of data shall be delivered by contractors and Partners as required by the contract or MOA and does not require GRC approval. However, to be a satisfactory delivery, the data must satisfy all applicable contractual requirements. The OPR/COTR designee has the responsibility to assure that the delivery meets applicable contractual requirements. Unless the OPR/COTR determines a deficiency, the contracting officer's direction is not required.

4.8.2 Deliverable Document Review Process

The CoNNeCT Project CMA receives the deliverables in an electronic media format delivered directly to the CMTS Request submittal site. Other means of document receipt would be Compact Disc (CD), via mail or other electronic means, but these are not the preferred method. The documents are then distributed to the designated reviewers via eRoom and OPR for review. The PMO assists CMA in determining the mandatory reviewers and establishing a due date for review comments. The author and the CMA tracks responses returned to the eRoom to ensure due dates are met. The author assesses all comments received and determines if they are accepted, rejected or require further discussion. Once all comments are dispositioned, either an Engineering Review Board (ERB) is held to present final updated document or the document is routed for signatures Out of Board (OOB). The review process is identified in Figure 4-2.

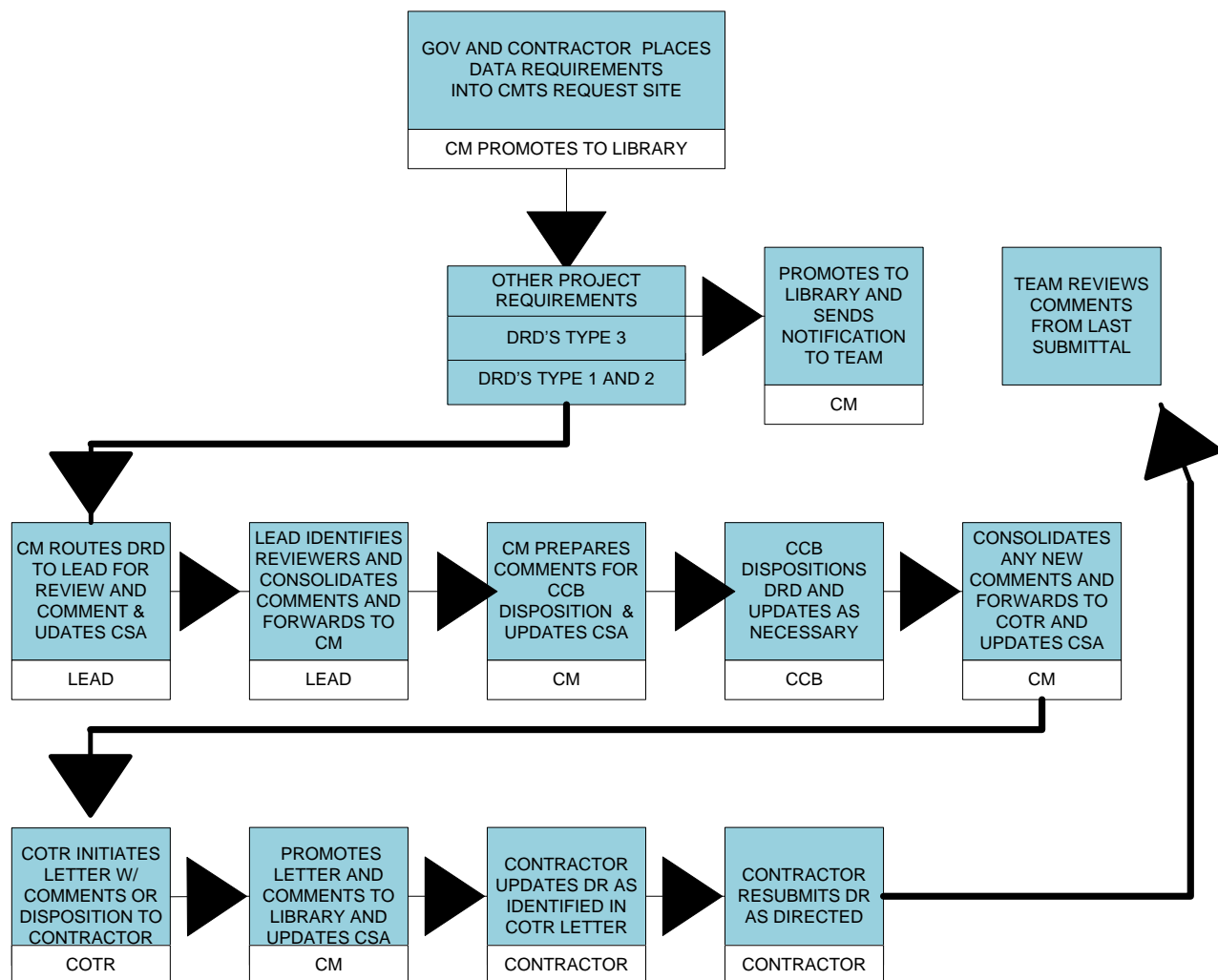


Figure 4-2—Deliverable Document Review Process

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The Configuration Data Management activities shall include reviewing the data requirements, contract provisions, and statement of work for required data items and data management tasks. These activities include designating a function responsible for each data item and discussing the requirements with the PMO to establish methods for preparation and review of the required data. The CML shall review and establish procedures and controls to ensure the preparation, review, approval, publication, submittal, and/or distribution of timely, economical, quality data. The author of each deliverable document shall review all data to be delivered and verify that it is complete and complies with the contract requirements and agreements. CM's review will be coordinated with PMO, Partners, and Subcontractors, and non-conforming data returned to the originator for rework.

4.9 Document Tracking

Configuration Management shall maintain a status accounting matrix document on all deliverable documents received from the CoNNeCT team members. CM will maintain a hard copy file of all documents received and reviewed. Within the CMTS system, documentation will be maintained as an electronic file. The CMTS system is capable of providing metrics on the status of documentation. Statuses available will include, but not limited to, date received, date distributed for review, revision, date CM approved and released. Status reports generated from CMTS are available on an as needed basis, but can be provided weekly or monthly and will be available to all CoNNeCT team members. Examples of documentation to be tracked are deliverable documents, drawings, Change Requests (CRs,) Request for Deviation / Waivers (RDWs), Memos, Directives, Process Plans, and status reports.

Configuration Management will also assist in the preparation of recommended Contract Data Requirements Directives, MOAs, and NASA Research Announcements (NRAs). These data deliverables and reviews shall establish a master contract delivery schedule depicting all data requirements. The CM analyst shall maintain records showing delivery performance and reports to management as necessary or required by contract. This will be accomplished by establishing and maintaining a data repository for all data and provide status accounting of each document in the CMTS document Library. The CMTS system shall be the authorized repository for CoNNeCT data requiring CM control and data that only requires repository managed.

4.10 Data Restrictions and Distribution

The contractor or Government organizations will determine and affix distribution statements to data in accordance with their contract and/or NASA center institutional policies. (See below.)

NPD 1440.6 NASA Records Management

NPD 2190.1 NASA Export Control Program

NPR 1441.1 NASA Records Retention Schedules (NRRS)

NPR 1600.1 NASA Security Program Procedural Requirements

NPR 2190.1 NASA Export Control Program

NPR 7120.5 NASA Space Flight Program and Project Management Requirements

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4.10.1 Access to Data

Access to data will be limited in accordance with the applicable distribution statements as well as by data rights, Contract Data Requirements Lists (CDRL) (if applicable), distribution, security requirements, and data status level.

4.10.2 Data Retention and Storage

The retention and storage procedures for CoNNeCT data are in accordance with NPR 1441.1, “NASA Records Retention Schedule” (NRRS). The NRRS has a series of 10 schedules approved by the Archivist of the United States, which furnish authoritative instructions for the retention, destruction, and retirement of records held by NASA Centers. The retention record for each document will be established at the time of document release. CM will document the retention information as part of the document’s attributes. Most CM artifacts are retired to the Federal Records Center when they are two years old and destroyed when they are 30 years old. Earlier destruction is allowed upon receipt of specific authorization from the pertinent Center Director or Program Manager.

4.10.3 Guidelines for Sensitive Data

The following NASA Policy Directive (NPD) and NASA Procedural Requirements (NPR) address the process for categorizing and handling sensitive data:

NPD 2200.1 NASA Scientific and Technical Information (STI)

NPR 2810.1 Security of Information Technology

4.10.3.1 Export Control

All documents will be reviewed for export and distribution restrictions. The Center Export Representative (CER) for the project is the single authority responsible for providing appropriate export control markings for all documents. Normally, the individual Office of Primary Responsibility (OPR) will work with the CER in making this determination.

4.11 Data Requirements Document (DRD) Review Status Reports

Configuration will publish status reports that identifies all documentation in review, mandatory reviewers and the review due date. If a DRD review is overdue the due date is flagged to identify reports that require immediate attention. This report is distributed to all document reviewers.

4.12 Monthly Deliverable Status Reports

Monthly, or as requested, CM will also provide a document tracking status to the cognizant Work Breakdown Structure (WBS) leads and PMO.

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4.13 Marking of Hardware and Parts

Configuration Items (CIs), Computer Software Configuration Items (CSCIs) and related equipment, facilities, and spares shall be identified by nameplates and markings per MIL-STD-130. The markings will depict part numbers, serial numbers or lot numbers, and Commercial and Government Entity (CAGE) codes. If the part is too small, or would be damaged by this identification, or the part is permanently installed in an assembly and is not replaceable as a unit then no markings are required.

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4.14 Manufacturing Practices

Manufacturing must verify that all items are manufactured in accordance with released engineering data by assuring that:

- Engineering orders changing flight hardware shall reference the change request number, which authorized the change.
- Manufacturing controls are capable of identifying the specific engineering changes incorporated in specific parts/subassemblies.

Figure 4-3 depicts the manufacturing controls and verification practices that will be invoked for the CoNNeCT Project. Refer to [Figure 7-2](#) for manufacturing change implementation and verification.

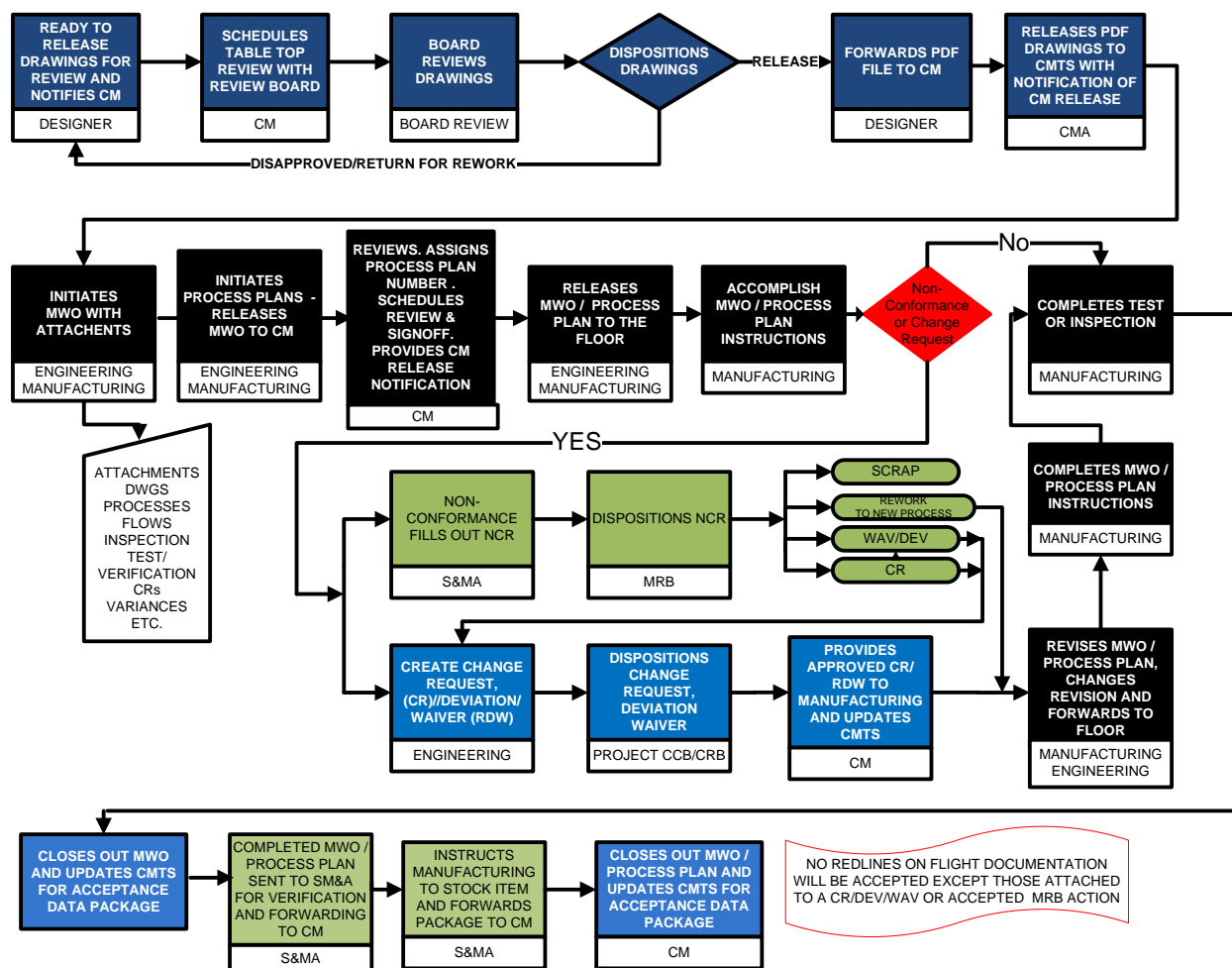


Figure 4-3—Manufacturing and Verification Process

6.0 BASELINES

A baseline is an agreed-to description of the Configuration Items of a product, at a point in time, which serves as a basis for defining change. Baselines are identified, documented, and controlled at specified times throughout the product life cycle as identified in the Program Design Reviews and Phasing as identified in Figure 6-1.

Configuration Identification consists of setting and maintaining a baseline that individually defines the System's Hardware Configuration Items (CI) and Computer Software Configuration Items (CSCI) at any point in time. Depending on the system life cycle phase, different baselines are progressively established. Baselines shall be established after each design review and continue throughout the development life cycle.

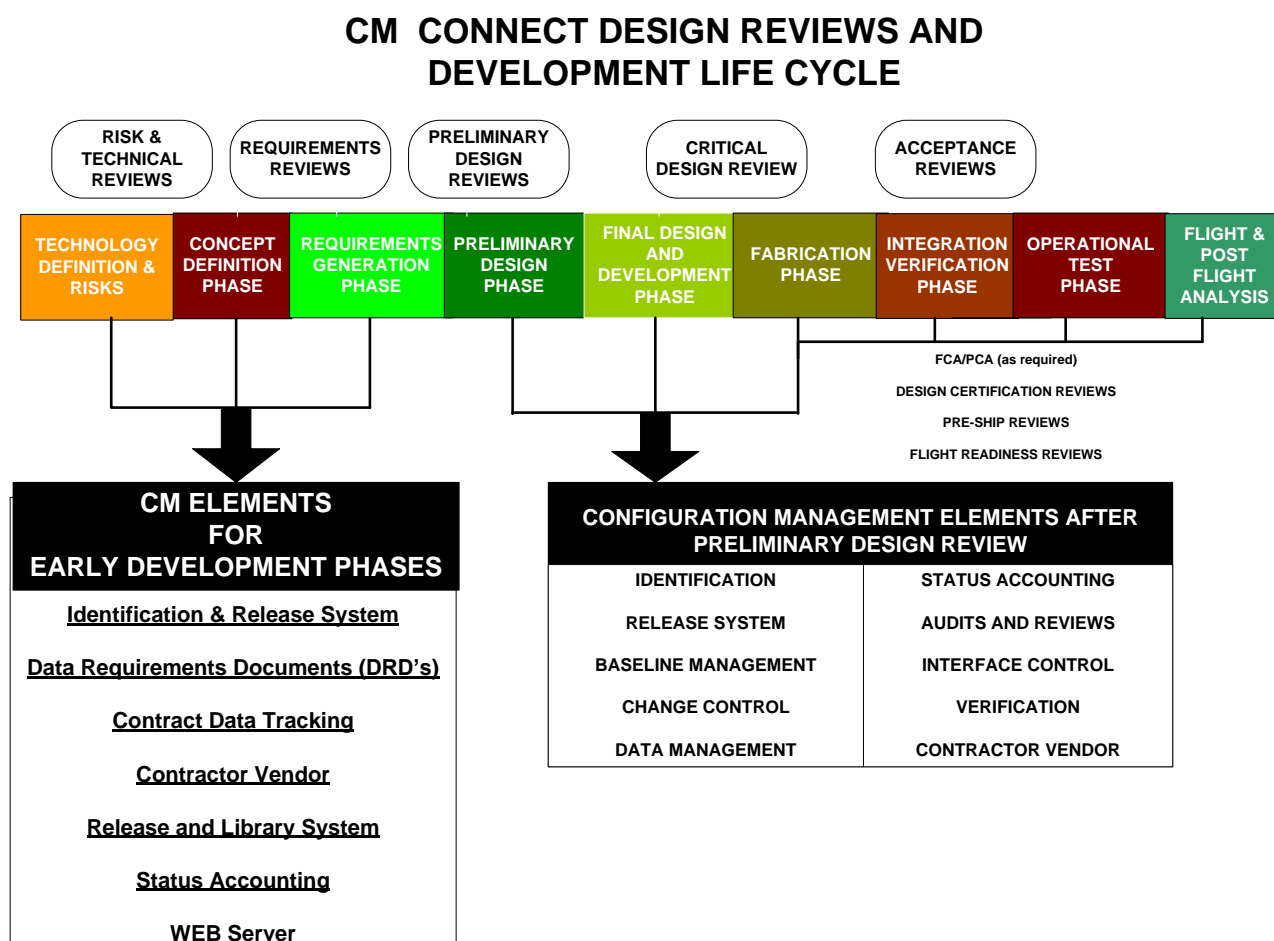


Figure 6-1—Project Design Reviews and Phasing

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6.1 Baseline Management

The GRC NASA Design Activity/Prime contractor baseline shall implement the allocated portion of the requirements of the NASA Program baseline requirements plus additional requirements defined by the design activity/contractor, such as those incorporated in CI/CSCI specifications and engineering drawings as concurred on by NASA following the appropriate design reviews as identified in the Program Integrated Schedule. [i.e. Risk Reduction Reviews, Preliminary Design Reviews (PDR), and Critical Design Reviews (CDR).]

6.1.1 Documentation Baselines

Documentation baselines (Controlled Documents) are established and maintained through the review, approval, and change control process. These "Controlled Documents" are version-controlled and maintained within the CoNNeCT Project Library and tracked through the CMTS Status Accounting System. Once established, all changes to a document baseline are identified, tracked, implemented, reviewed, and approved by NASA as the Requirements Documentation Baseline. These documents are controlled by NASA.

The CCB establishes a baseline by documenting and certifying that the product requirements (established by the Program/Project Team) have been met. Once a baseline is established, the CoNNeCT Control Board (CCB) or the Change Review Board (CRB) will review and disposition proposed changes to that baseline. Only approved changes to the baseline will be implemented. Baselines and change documentation will be maintained using the appropriate change management identified in this plan. Baselines will be stored and maintained in the CoNNeCT Project Library and tracked through the CMTS Status Accounting System.

6.1.2 Functional Baseline

The initial requirements for the CoNNeCT System are defined in the System Specifications, where functions are specified in a descriptive manner and qualified by performance parameters. Working from these specifications, the System design/analysis shall be defined and specified in greater detail (decomposed) by subsidiary specifications or prime item development specifications and Interface Control Drawing documentation, down to equipment specifications. When authenticated, these documents shall establish functional baselines for the specific system end items. The establishment of the Functional baseline shall occur no later than the Formal "Preliminary Design Review" (PDR).

6.1.3 Allocated Baseline

The Allocated Baseline shall be used to govern the development of selected Configuration Items; hardware CI and software CSCI that have been allocated from system requirements established in the Functional baseline or are part of a higher level Configuration Item. For Hardware Configuration Item (HWCI), the timing of the establishment of the Allocated Baseline for each HWCI shall be agreed to before the Formal Critical Design Review' (CDR) and consist of the drawings and hardware Development Specifications. For each CSCI, an Allocated Baseline shall be established upon successful completion of the Formal Software Specification Review (SSR) and shall consist of the specific CSCI Software Code developed and controlled, as specified in the Software Configuration Management Plan, GRC-CONN-PLAN-0001. Software documents developed and released shall be governed by the CM processes identified in this CM document.

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6.1.4 Product Baseline

The Product Baseline for an end item and each of its hardware configuration items shall be established at the successful completion of the Physical Configuration Audit (PCA) for each identified HWCI and CSCI. There will be no Formal PCA conducted on CoNNeCT hardware, but rather an inspection and acceptance or test on each item, subassembly, and final assembly shall be conducted to ensure compliance with required specifications and drawings. The Product Baseline shall prescribe the necessary "build-to" or form, fit and function requirements and the Acceptance Test Procedures for the HWCI requirements. The relevant function or fabrication product specification shall establish the Hardware Product Baseline for each HWCI. The Product Baseline shall be defined in terms of drawings, assemblies, and component part numbers. This baseline shall be the point of departure for all activities in the subsequent phases of the project, leading to production (manufacture) and in-service operation of the CoNNeCT System. It shall constitute the datum line for the Production Change procedure (referred to as Modifications).

The Software Product Baseline for CSCI's is established after the source code listings and design documentation for the CSCI's are approved and documented within the Software Product Specification.

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7.0 CHANGE MANAGEMENT

Configuration Change Management is the process for managing product configuration changes and tracking those changes to baseline hardware, software, and documentation beginning at a specified time in the product life cycle. The purpose of change management is to:

- Enable change decisions to be based on knowledge of complete change impact
- Limit changes to those that are necessary or offer significant benefit
- Facilitate evaluation of cost, savings, and trade-off
- Ensure customer interests are considered
- Provide orderly communication of change information
- Maintain configuration control for product baselines
- Maintain consistency between product baselines
- Facilitate continued supportability of the products

The change management discipline is applied to an established CI (software and/or hardware) and/or CI component at a specified time in the development life cycle beginning with the initial Documentation Baseline.

7.1 Change Initiation

Any Program/Project team member or end user may initiate a Change Request (CR). Upon initiation, the CR is forwarded to the CMA for classification and evaluation. Change Request forms will be provided by the CMA for CoNNeCT Products. These will be electronic forms that will be initiated and processed through the Configuration Management Analyst. The CR forms are located in CMTS. The CoNNeCT development team shall accomplish their responsibilities in the change control process by identifying technical requirements for baselining, proposing changes and insuring the implementation of CRs as identified in the flow process depicted in Figure 7-1.

There shall be no redlined markup drawings allowed for Flight drawings. A Fast Track process may be used for class II documentation changes only. Documentation changes, that may impede the progress of manufacturing, may be processed using a Fast Track CR. The problem shall be evaluated by engineering, and if determined no hardware / software is impacted by the change, a CR is generated that requires only three signatures to move forward - The cognizant Engineer, WBS Lead, and Quality Assurance (QA). The signed Fast Track CR shall be forwarded to CM within 24 hours. Configuration Management will evaluate the Fast Track Change and process it for further review and approval by the remaining CRB members. If engineering or quality determines the change is not documentation only, the CR shall be forwarded to CM for formal approval prior to manufacturing implementation. All other required changes for Flight drawings must be formally processed through the CRB for approval and release prior to implementation of any change into the hardware.

Procedures and Process Plans may be redlined without requiring the generation of a CR. Any redline change shall be reviewed, signed and dated by the cognizant Lead Engineer and QA prior to manufacturing release.

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Redlines are allowed for use with the GSE / GFS hardware. A CR will be generated from the marked-up redline drawings at the completion of build for each drawing updated with manufacturing redlines.

7.2 Change Evaluation

One important aspect of the Configuration Control process is that it provides adequate analysis of changes in terms of determining impact to system functionality, interfaces, utility, cost, schedule, and contractual requirements. Each change should also be analyzed for impact on software, safety, and reliability. The Change Review Board (CRB) will evaluate the change request to determine; a) if it is valid, b) if it impacts one or more current product baselines (internal or external), c) if the change is classified as Class I and Class II as defined in this document, and d) how the product/project may be affected by the change in terms of established program/project objectives (i.e., safety, cost, schedule, contractual requirements, interfaces, etc).

7.3 Change Processing

Changes that are documentation in nature are classified as Class II and may or may not be routed through a Fast Track process depending on manufacturing's schedule needs. Changes that affect the form, fit, or function of a CoNNeCT baseline are classified as Class I and must first receive approval through the appropriate Change Review Board (CRB). Configuration Change Management is the systematic process for evaluating, coordinating, and dispositioning proposed changes, and implementation tracking and verification for those changes to baseline code and all associated documentation and data.

The change control process ensures that the changes are initiated, classified, evaluated, approved/disapproved, documented, implemented, tested, and incorporated into a new baseline, as applicable. An orderly change process is necessary to ensure that only approved changes are implemented into any baseline product. Figure 7-1 shows an overview of the CoNNeCT change control process.

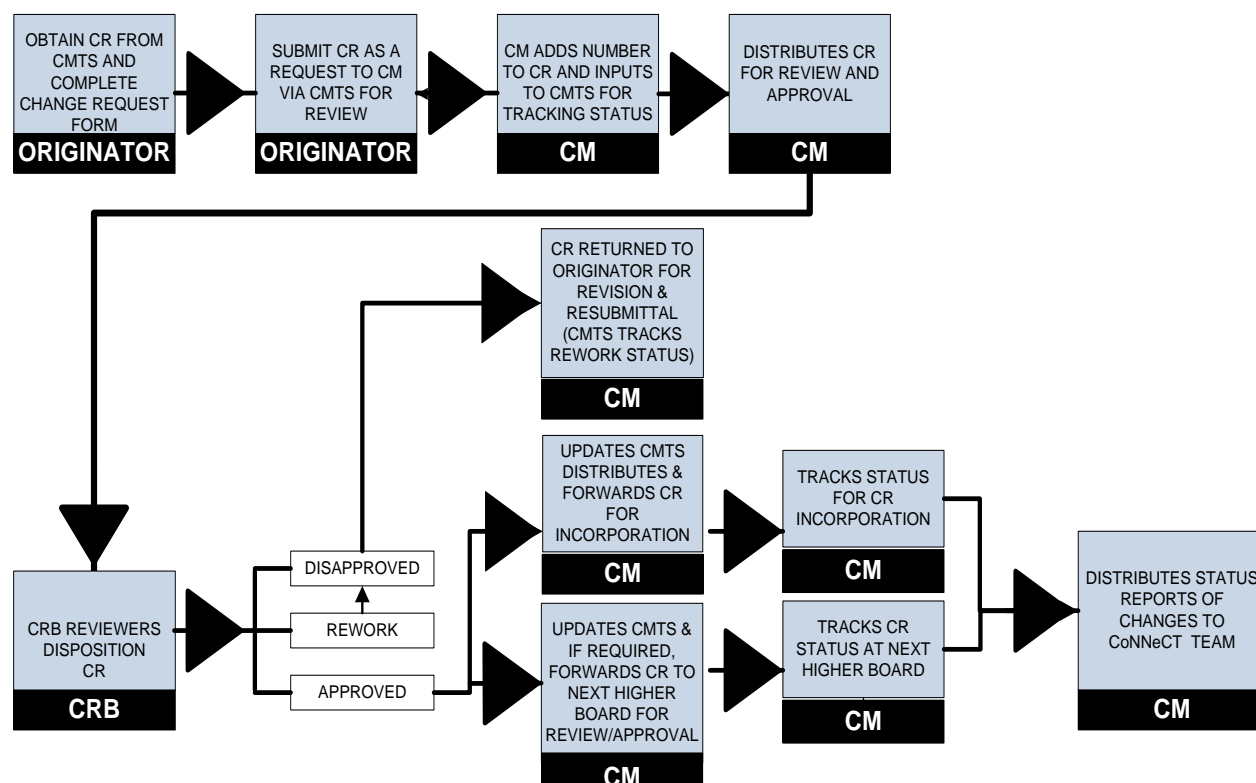


Figure 7-1—CoNNeCT Change Control Process

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7.4 Change Classification

Changes to CoNNeCT products are classified according to the impact of the change and the approval authority needed to proceed with the change. A Class I change is one that affects the system level requirements, external interfaces, system cost, and/or schedule. Class I changes are approved by the Project CRB members who were the original signatories on the released document, and any members determined necessary to adequately evaluate the change. Class II changes are those that do not affect form, fit, function, cost, or schedule. Class II changes are approved by the CRB members who were the original signatories on the released document, and any members determined necessary to adequately evaluate the change.

The numbering scheme for change requests will start at CONN-CR-0001. They will be numbered sequentially by the Configuration Management Analyst, and the CMTS system. Once the CR is approved, CM will release as baseline and issue direction to update the necessary documentation.

Depending on the complexity of the changes, implementation into the drawing may be held until there are a maximum of three changes against a single drawing. The Lead Engineer, along with input from manufacturing, will determine if a single change should be incorporated.

7.4.1 Class I Change

A proposed change to a Configuration Item (CI) shall be determined to be Class I, if the CI is affected to the extent that any of the following requirements would be outside the specified limits or specific tolerances.

- Hardware
- Performance
- Weight, balance, moment or inertia, size
- Interface
- Interchangeability
- Safety
- Electromagnetic characteristics
- Cost and Schedule
- Reliability
- Retrofit of accepted items
- Power Requirements
- Configuration of delivered hardware or software
- Compatibility with Ground Support Equipment (GSE), Facilities, or Trainers
- Procurement Specification, Design Specifications, Source Control Drawings, Interface documents
- Contract Provisions
- Configuration of hardware and software accepted by NASA
- Government Furnished Hardware
- Critical Processes and Procedures
- EEE Part List
- Operational Software after Acceptance Review

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7.4.2 Class II Change

A proposed engineering change shall be designated as Class II when it does not fall within the Class I definitions as described above. Typically, Class II changes are merely clerical; or they document minor changes to deliverable hardware and do not affect form, fit, function, cost, or schedule; or they affect only unique internal documentation, processes, hardware and/or software. Class II changes are subject to approval by the Change Control System. Class II changes shall be distributed to CRB members as determined necessary to adequately evaluate the change.

7.5 Change Disposition

The CRB provides the disposition for each CR. The CRB assesses the desirability of a change in terms of schedule/resource impacts and project objectives, as described in the evaluation documentation. The CRB may approve, disapprove, or defer a CR. Additional information may be requested by the CRB, which will defer disposition.

Once a disposition has been assigned by the CRB, the CR is forwarded to the CMA for action. A disapproved CR is sent to the originator along with CRB rationale for rejection. A CR needing further analysis is sent back to the analysis group with the CRB questions/issues attached. A deferred CR is put in “Hold” status and resubmitted to the board as directed.

The CMA sends the approved CR to the development organization. If additional levels of approval are needed, the CML submits the CR package to the next higher level CCB. The CML, acting as the secretariat of the CCB, then prepares and distributes the meeting minutes, and records the current status of the CR. This information is maintained in the Configuration Status Accounting System.

7.6 Change Implementation

Approved CRs are directly used as a change authorization. The CM Analyst is the key contact point, assigned the duties of coordinating CRB approved changes through the change implementation processing cycle. The CMA tracks the generation, release, and implementation of changes.

The development organization is responsible for acquiring and scheduling the resources to make the necessary changes to both the hardware/software and all documentation associated with the CR. (these resources are allocated during the CR evaluation phase). The development organization “checks-out” an official copy of the baseline component(s) (documents) to be changed through the CMA from the CMTS Project Library.

For Pro-E files of mechanical drawings that need CRs incorporated, the developing organization is responsible for obtaining these files from the Windchill software system that is maintained by the responsible designer.

For AutoCad files of electrical drawings that need CRs incorporated, the developing organization is responsible for obtaining these files from CM where the latest AutoCad files are stored in the CMTS Library.

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For software changes, the requirements and design documents are updated (as mandated by the change evaluation and approved by the CCB), code updates are made, documents are updated, and test/verification is performed on all products changed. Once the change has been made and local testing completed (including regression testing), the revised component and documents are returned to the control of the Project Library. Upon verification, the new version takes its place in the sequence of baselines and the previous baseline is archived and recorded in the Status Accounting System as documented in the Software Configuration Management Plan, GRC-CONN-PLAN-0001

7.6.1 Configuration Management Verification Process

Configuration verification is a process that is common to configuration management, systems engineering, design engineering, manufacturing, and quality assurance. The functional aspect of configuration verification encompasses all of the test and demonstrations performed to meet the quality assurance sections of the applicable performance specifications. The tests include verification/qualification tests performed on a selected unit or units of the CI, and repetitive acceptance testing performed on each deliverable CI, or on a sampling from each lot of CIs, as applicable. The physical aspect of configuration verification establishes that the as-built configuration is in conformance with the as-designed configuration. The design cognizant of the CI accomplishes this verification by physical inspection, process control, or a combination of both.

Once the initial configuration has been verified, approved changes to the configuration must also be verified. Figure 7-2 illustrates the elements in the process of implementing an approved change.

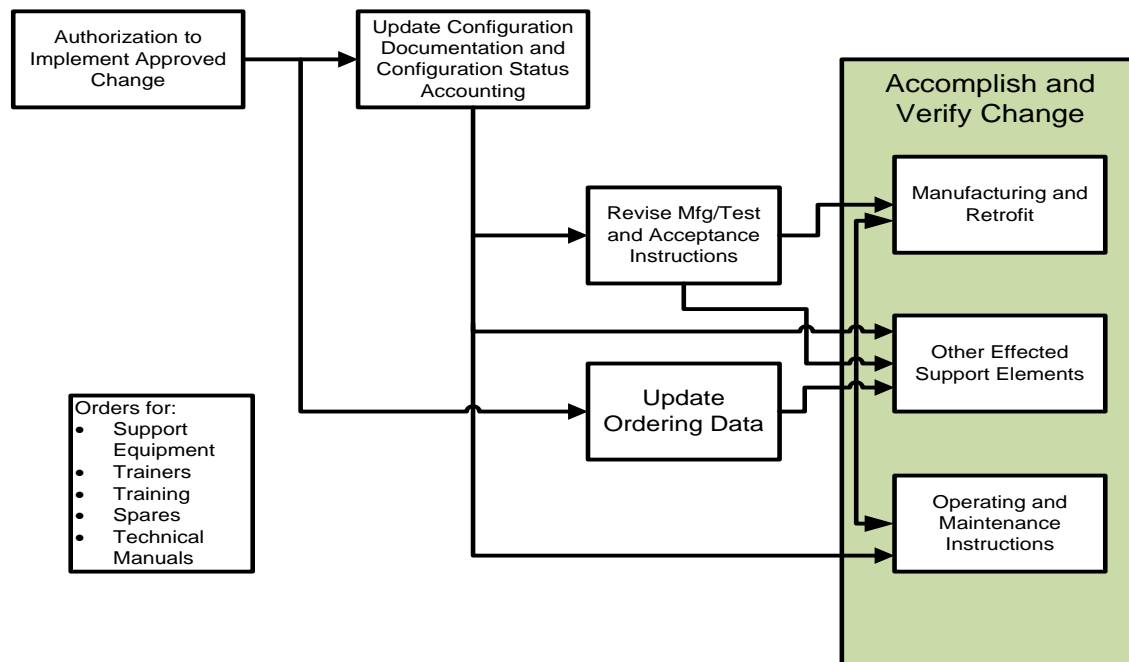


Figure 7-2—CoNNeCT Manufacturing Change Implementation and Verification Process

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7.7 Deviation and Waivers

Where a drawing or specification is correct and manufacturing error(s) occur, an NCR must be generated to document the problem and start the process to evaluate and determine a solution. If the defect is found to be acceptable or a fix other than the released documentation is proposed, a form "Request for Deviation/Waiver" (RDW) shall be completed by Manufacturing / Engineering. The RDW will recommend that the item be accepted as is, repaired, or dispositioned for some form of repair, in lieu of scrapping an otherwise functional component simply because it does not exactly conform to the drawing or standards. Deviations and Waivers should not be used to avoid processes required by the acceptance process and should be requested with the intent that they are a onetime departure and will not become a recurring request. Deviations and Waivers shall be processed in accordance with the Product Assurance Plan (GRC-CONN-PLAN-0006).

7.7.1 Requirements for Deviations

Simply put, a Deviation is an intended temporary departure from the mandatory baselined requirements of a specification, drawing, or document. They generally are requested prior to the manufacture of an item. However, a post manufacturing departure from requirements may be considered as a deviation if the departure was intentional. Rationale to justify the need for the Deviation shall also include what means shall be taken to preclude a recurrence of the change.

An upfront request from a developer/supplier for a one time departure from any requirement(s) may be authorized via a CRB approved deviation. Items shall not be delivered incorporating a known departure from documentation unless a request for deviation has been submitted and approved.

7.7.2 Requirements for Waivers

Contrary to a Deviation, a Waiver is an unintentional temporary departure from the baseline. Waivers are requested due to an oversight in the manufacturing process and suggest a flaw in the overall quality system of the manufacturer. Therefore, it is of prime importance that an appropriate corrective action be defined and documented as part of the rationale in the body of the waiver. The corrective action shall be sufficient to preclude the chance for any recurrence of the waiver's intent. Upon discovery of the non-conformance, an NCR will be generated and processed/dispositioned through the Material Review Board (MRB) as described in the section covering NCRs and MRBs below. To ensure closed-loop processing, the problem report, NCR number should be referenced on the waiver, and the waiver number should be referenced on the NCR.

Supplies or services, which do not conform to all aspects of the contractual requirements, shall normally be rejected. An item, which, through error during manufacturing, does not conform to the specified configuration documentation, shall not be delivered to NASA unless a waiver has been processed and granted.

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7.7.3 Deviation/Waiver Submittals

All deviations and waivers shall be initiated in accordance with the CoNNeCT Product Assurance Plan, GRC-CONN-PLAN-0006, and procedures. Once the initiator completes the deviation/waiver form, it is submitted to the Configuration Management Analyst for numbering. Upon receipt of a deviation/waiver, Configuration Management shall route it to the CRB members for review and approval.

7.8 Problem Reporting and the Material Review Board

CoNNeCT has in place a non-conformance problem reporting system for initiating, tracking and dispositioning NCRs. Anyone can initiate an NCR upon the discovery of a non-conformance. (Refer to the section covering “Nonconformance and Problem Reporting and Control” in the CoNNeCT Product Assurance Plan, GRC-CONN-PLAN-0006 and the Project Plan, GRC-CONN-PLAN-0004, for further guidance on problem reporting and the Material Review Board.)

7.8.1 Material Review Board

The Material Review Board (MRB) is chartered by the Project Office and chaired by the S&MA representative. Membership roles and responsibilities are defined in the Product Assurance Plan and the Project Plan. All NCRs will be addressed and dispositioned by the MRB. A problem report may be generated for a particular problem that requires a design change or requires a RDW as the resolution. In either case, to ensure a closed loop system, a CR or RDW number is obtained and referenced as the resolution in the NCR. The related NCR number shall also be referenced on the CR or RDW. The applicable NCR should remain open in the system database (for closed loop tracking), until the CR or RDW is approved and released. Figure 4.3 – Manufacturing and Verification Process, in this plan, depicts the MRB’s role in the manufacturing process.

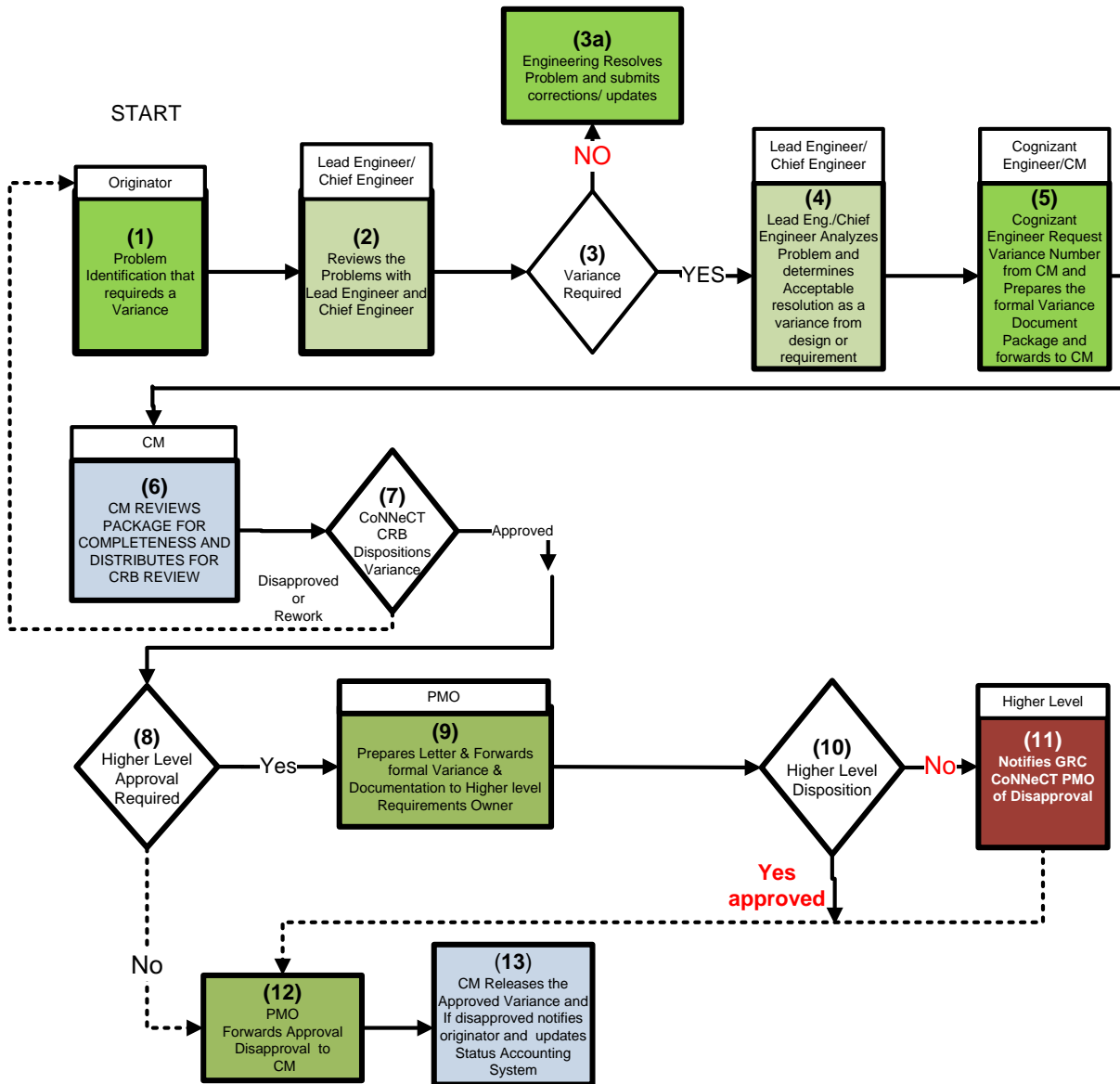


Figure 7-3—Waiver/Deviation Process

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7.9 Technical Reviews and CoNNeCT Control Board (CCB)

The CoNNeCT project level boards are chartered by the Project Manager as set forth in the Project Plan, GRC-CONN-PLAN-0004. The Change Review Board (CRB) is chartered by the Project Manager as set forth in this CM Plan.

7.9.1 CoNNeCT Engineering Review Board (ERB)

The CoNNeCT Engineering Review Board (ERB) is chaired by the CoNNeCT Chief Engineer. The ERB members will include the Systems Engineering and Integration Lead, Experiment Communications System Lead, the Flight Systems Lead, Software Lead, Mission Operations Lead, and the CoNNeCT Safety and Mission Assurance (S&MA) representative. The Chief Engineer will solicit Discipline Lead Engineers and Subject Matter Experts to be members depending on the content of technical issues. The Project Manager and Principle Investigator are ex-officio members.

The ERB will disposition all engineering issues brought before the board. The ERB resolution and all documentation, after the Chief Engineer signs the ERB disposition form, will be given to the Project Configuration Management Lead for archiving. The ERB will review engineering reports, design review documentation, and investigate engineering issues. ERB decisions impacting programmatic issues will be reviewed and dispositioned by the CoNNeCT Control Board (CCB).

7.9.2 CoNNeCT Control Board (CCB)

The CCB for technical reviews will be comprised of representatives from the following subprojects. Subproject managers may delegate element leads to represent the subproject as dictated by the subject matter to be discussed.

- Project Manager or designated representative (Chair)
- Principal Investigator (PI)
- Systems Engineering and Integration
- Project Leads as required
- Office of Safety and Mission Assurance Representative
- CM Board Secretariat (non-voting member)
- Deputy for Resources (non-voting member)
- CM Lead (non-voting member)
- Ad Hoc members as directed by the Chair

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7.9.2.1 CoNNeCT Control Board Secretariat

The CoNNeCT Control Board Secretariat is responsible for:

- Compiling and distributing agenda for the CCB
- Recording minutes for the CCB
- Recording and tracking CCB action items
- Presenting draft copies of the minutes to the Project Manager for signature
- Distributing copies of the minutes to the board members
- Processing documents through the CoNNeCT eRoom system
- Status accounting for all documentation processed through the CCB
- Other Board related tasks as designated by the Chair

7.9.3 Change Review Board (CRB)

The CRB is responsible for the review and approval of initial released documentation and change documentation generated to revise or deviate from approved documentation. The CRB will be comprised of representatives, depending on the documentation being reviewed, as shown in previous sections of this document.

- The Change Review Board is responsible For: Review, comment and approve initial released drawings and documents
- Review Change Requests and RDWs for comment and approval
- Board members are comprised of the cognizant functional responsibilities determined by the areas impacted by the documentation, Change Request or RDW in review

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8.0 CONFIGURATION STATUS ACCOUNTING AND LIBRARY SYSTEM – CONFIGURATION MANAGEMENT TRACKING SYSTEM (CMTS)

The Configuration Management Tracking System (CMTS) will identify and track CM released data and provide on-line status reporting. The CMTS, developed for the CoNNeCT project, will be used for the CoNNeCT Project Library to store CM approved and released documents and drawings. This system ensure that both in-house and contractor released documentation will be accurately reflected in CM's status accounting system. This system is required to ensure a closed loop, clear audit trail exists in both directions between authorization and hardware implementation. The system requires tracking implementation to the hardware effectivity specified in approved changes.

Objectives of the Configuration Status Accounting (CSA) function include tracking and reporting:

- Detailed information for each CI and associated documents
- History and status of proposed CoNNeCT Project Documents, CRs, Deviations / Waivers, Directives, Process Plans and Action Items
- Implementation status of approved changes
- Metrics data
- Verification and audit results
- Establish record retention for documentation upon release

As products are released, the Quality Records associated with the identification and approvals of those products are entered into the CSA System. The CSA System is the primary source of information generated by CoNNeCT products and processes. This information enables CoNNeCT team members to make informed decisions regarding status of the CoNNeCT System.

The Configuration Status Accounting information will be maintained using automated CM tools (CMTS) and the CoNNeCT eRoom. The required CSA Reports will be dictated by needs of the Project Team and provided on an as required basis. Following are examples of reports that may be generated from the CMTS System. Ad hoc queries and reports may also be produced.

- Indentured listings of products/Components
- Specification Revision Level/History
- Document/Drawing Revision Level/History
- Approved Change listings
- Current Software Version Level
- Software Version History
- Deviation / Waiver Status
- Change Request Status
- Configuration Unit as Designed List
- Configuration Unit as Built Configuration List
- Build and Modification Kits Installation Status
- Status of Software Change Requests
- Contract and SOW
- Directive Status

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8.1 CoNNeCT Library Operations

The project library is operated by and under the control of the Configuration Management. Efficient operation of the library is enhanced by the use of automated tool. The CMTS is an automated tool, used in conjunction with the eRoom, by ZIN Corporation for use on the CoNNeCT Project. The CMA librarian does the actual storage and physical control of the contents of baselines.

The role of the project library and Configuration Management Analyst includes the storage and control of hardware and associated documentation. The program library shall control hard copy documents, computer files, and the physical media on which the latter is stored. It will be governed by procedures for archiving old versions of the system, controlling the current version, and accepting (from developers) potential new versions, which will be verified. In addition, as the project librarian, the CMA is responsible for the maintenance of records and the creation and publishing of related reports.

The CMTS library shall contain the official master copies (Word / Excel / AutoCAD) as well as working copies of all baselined documentation items that make up the various CIs. It contains all baselined items, of which working copies are checked out by the librarian for authorized changes to be made, and are checked back in after the change process is complete. CMTS will maintain PDF versions of released electrical and mechanical drawings and the electrical AutoCAD files. The master files for ProE drawings will be maintained in Windchill by the cognizant designer. All models used in the analysis of hardware (Thermal, Structural) will be captured, managed, and stored in the CMTS library. The CMA librarian operates the program library to manage the baseline hardware, data, and documents. The librarian accepts documents, data files, and other components of baselines and puts them in secure storage within the CMTS system. The CMA librarian issues working copies to developers for incorporating authorized changes, and keeps records and historical copies of all versions of the components of baselines. The Librarian shall make copies of baselined hardware and software documentation for testing and distribution purposes.

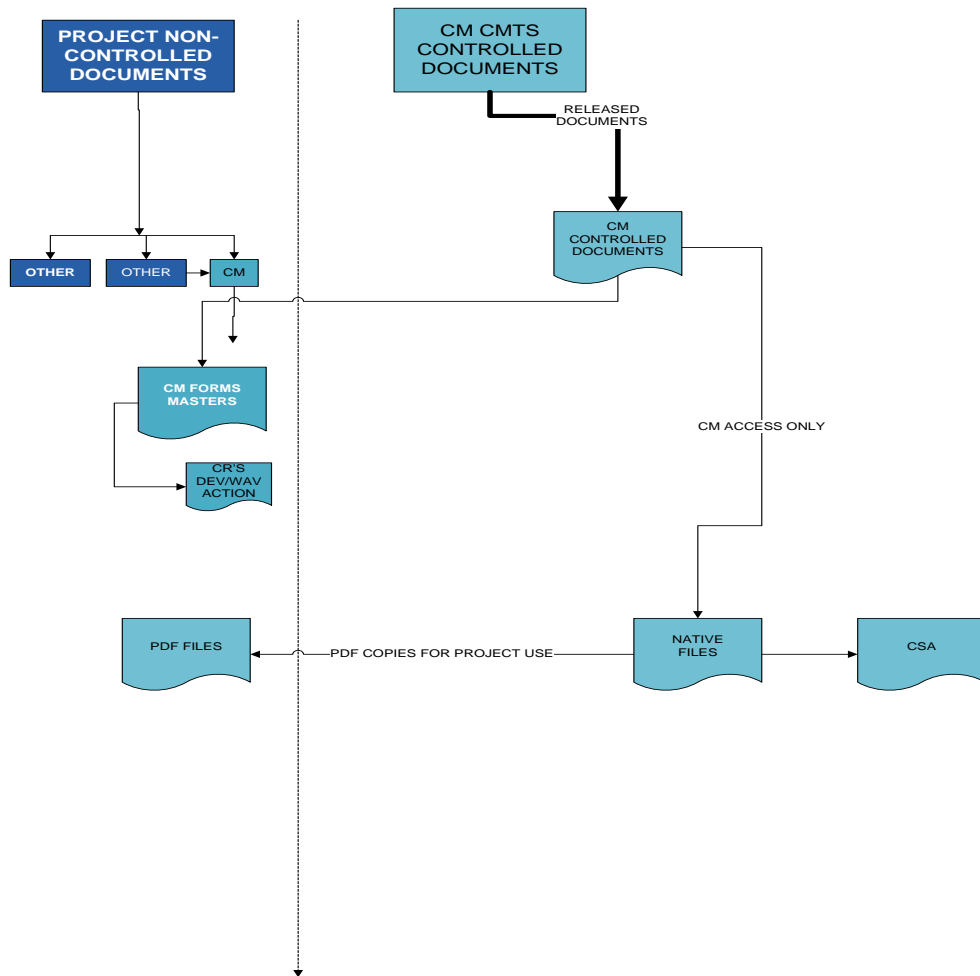


Figure 8-1—Project Library Operations Support Example

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9.0 MANUFACTURING AS BUILT DATA

Upon the completion of build and test, all associated manufacturing documentation shall be forwarded to Configuration Management for retention. This shall include, but not limited to, Process Plans, completed test and assembly procedures and reports.

The manufacturing documentation will be stored by CM for Project use in the completion of the final Acceptance Data Package (ADP) for CoNNeCT hardware.

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10.0 PROJECT REQUIREMENTS REVIEWS

10.1 Project Requirements Reviews

The CoNNeCT Requirements Reviews will be conducted to ensure that all baseline requirements and interface requirements are identified and are properly flowed down to systems level management and technical documentation. This includes cost and schedule data, interface documentation, system specification, and project level plans. The requirements reviews will assist in the verification process for project requirements and their implementation. The various CoNNeCT reviews are covered in detail in the CoNNeCT Systems Engineering Management Plan, GRC-CONN-PLAN-0005.

10.2 Preliminary Design Review (PDR)

The CoNNeCT Preliminary Design Review was successfully conducted early in the design phase. The PDR is a basic technical design approach for configuration items and for selected major changes to these items to assure compatibility with the CoNNeCT Project and project requirements (including interface requirements) and the producibility of the design approach. Typically, the items for review at the PDR include the following:

- Preliminary Interface Documents
- End Item Specifications
- Top Level Drawings
- Design Analysis
- Layout, general arrangement, and envelope drawings
- Schematics and block diagrams
- Sizing, trade studies, and design study results
- Material and process specification listings
- Applicable design specifications
- Test requirements
- Updated Plans and Procedures
- Commonality candidates: identification, rationale and status
- Critical Items List (CIL) hazards analysis, etc.
- Selected Product Assurance\S&MA documentation (preliminary Failure Modes and Effects Analysis (FMEA), CILS, Hazard Analyses, etc.)

The PDR resulted in the authorization to proceed with further design in accordance with the reviewed approach, interface requirements, commonality items etc., and approval to update the baseline documentation. .

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10.3 Critical Design Review (CDR)

The CoNNeCT Critical Design Review was successfully conducted when the detailed design was approximately 90 percent complete for configuration items. The purpose is to determine the compliance of the completed design with requirements. Typically, the items for review at CDR include the following:

- Interface Control Documents
- Detailed design drawings
- Design analyses and reports
- Test data
- Procurement specifications
- Mock-ups and models
- Prototypes, breadboards, models
- Material and process specifications
- Commonality hardware status reports
- Project procedures and schedules
- Proposed additions to the baseline
- Status of Qualification Program
- Selected Product Assurance\S&MA Documentation (FMEAs, CIL, Hazard analysis, Fault Tree analysis, etc.)
- Verification/Certification requirements and procedures
- Acceptance requirement
- Traceability of baseline requirements to the basic design approach

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11.0 CONFIGURATION AUDITS

11.1 Quality Control, Inspection, Audit and Surveillance Practices

Independent of the technical and production functions, Product Assurance with assistance from Configuration Management shall:

- Assure that released engineering data is in accordance with requirements
- Audit Manufacturing Work Orders and assure that manufacturing and quality control documentation is in accordance with released engineering data
- Inspect material control, manufacturing and process control, and assembly operations to verify that approved changes have been incorporated and are acceptable.

11.2 Configuration Audits & Verification

Verification of the hardware configuration assures that all requirements and engineering changes have been correctly translated into the hardware/software. Periodic verification is performed during design reviews where progressive project baselines are established. Tools used to achieve this continuous verification are:

- Release system
- Status accounting system
- Manufacturing practices and inspection
- Audit and surveillance practices

No formal FCA or PCA is scheduled, or required, for CoNNeCT hardware. An informal FCA/PCA will be conducted as part of the normal acceptance process for all detailed and assembly hardware. At the discretion of the CoNNeCT Project Management, an FCA/PCA may be conducted with the Acceptance Review. The FCA is the formal examination of functional characteristics of the CoNNeCT products to verify that the item has achieved the requirements specified in its functional and allocated configuration documentation. The PCA is the formal examination of the “as-built” configuration of CoNNeCT hardware and software Configuration Items against its technical documentation to establish or verify the CoNNeCT product baseline.

11.3 Contractor Vendor Control

The management of Configuration must be passed down to the Contractor and vendors as well. They will also be subject to audit. The CMA will support SM&A for in-house audits and contractor activities and records as necessary to verify the adequacy of configuration management procedures and the implementation of the requirements of this plan.

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12.0 FIELD CHANGES AND MODIFICATIONS

12.1 Delivery of Hardware

After delivery and acceptance of a Configuration Item (CI) from or to another NASA agency or contractor, modification may be required to incorporate approved changes or correct non-compliances with hardware/software from the delivering agency. As applicable, it shall be provided as a modification (mod) kit. The mod kit shall be proposed by a formal change request and approved by the appropriate CCB before shipment. Mod kits shall be shipped using DD Form 1149, Government Shipping Document, and/or DD Form 250, Material Inspection and Receiving Report. A copy of the DD Form 1149 and/or DD Form 250 shall be forwarded to Configuration Management for inclusion in the final ABL documentation.

12.2 Field Engineering Changes and Mod Kits

The Field Engineering Change (FEC) is used to authorize engineering changes to hardware at a NASA use site when time constraints do not allow preparation of a formal CR. It should be used only for changes, which require disposition within 24 hours. A FEC authorizes the change, but should be followed by a formal change request to update the affected “as-designed” documentation.

The FEC shall be limited to one serial numbered item affectivity and shall be followed up by a Change Request (CR) to implement changes in the remaining serial numbered items and inclusion into future builds. FEC numbers will be assigned and controlled by the site representative as determined by the CoNNeCT PMO.

FEC numbers shall be prefixed by the letters “FEC.” Implementation of the FEC shall be documented on an Installation Notice Card (INC). Copies of the INC shall be sent to the CMA and the design activity.

The mod kit shall contain all the hardware/software/documentation needed to correctly incorporate the required change. Modification Instructions serve as a checklist for kit completeness and provide the step by step instructions for accomplishing the modification. The Modification Instructions should include the following information: Modification Instructions title, Modification Instructions number, authorizing change request number and PCN, date, any spares or manuals affected, safety considerations, Modification Instructions, purpose, affectivity, list of parts/materials/documentation contained in the kit, instructions for mod kit installation, a list of any validation requirements, special handling/tools/safety equipment/test equipment required, estimated man-hours required, who prepared the kit, and who inspected the kit before shipment. Installation of the Mod Kit shall be documented on the Installation Notice Card (INC). Copies of the INC shall be sent to the CM Analyst and the design activity.

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APPENDIX A ACRONYMS AND ABBREVIATIONS

A.1 Scope

This appendix lists the acronyms and abbreviations used in this document.

A.2 List of Acronyms and Abbreviations

Table A-1—Acronyms and Abbreviations

ABL	As-Built List
ADP	Acceptance Data Package
ANSI/EIA	American National Standards Institute/Electrical Industries Association
ASME	American Society of Mechanical Engineers
CAGE	Commercial and Government Entity
CB	Change Board
CCB	CoNNeCT Control Board
CD	Compact Disc
CDM	Configuration Data Management
CDR	Critical Design Review
CDRL	Contract Data Requirements Lists
CER	Center Export Representative
CI	Configuration Item
CIL	Critical Items List
CM	Configuration Management
CMA	Configuration Management Analyst
CML	Configuration Management Lead
CMO	Configuration Management Office
CMP	Configuration Management Plan
CMTS	Configuration Management Tracking System
CoNNeCT	Communications, Navigation, and Networking reConfigurable Testbed
COTR	Contracting Officer's Technical Representative
CR	Change Request
CRB	Change Review Board
CSA	Configuration Status Accounting
CSCI	Computer Software Configuration Items
DD	Defense Department
DM	Data Management
DRD	Data Requirements Document
EEE	Electrical and Electronics Engineers
ELC	Express Logistics Carrier
ERB	Engineering Review Board
FCA	Functional Configuration Audit
FEC	Field Engineering Change
FMEA	Failure Modes and Effects Analyses
GFS	Ground Flight Support

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GIU	Ground Integration Unit
GLPR	Glenn Procedure
GRC	Glenn Research Center
GSE	Ground Support Equipment
HWCI	Hardware Configuration Item
IAW	In Accordance With
ICD	Interface Control Document
INC	Installation Notice Card
ISO	International Organization for Standardization
ISS	International Space Station
MIL-STD	Military Standard
MOA	Memo Of Agreement
MRB	Material Review Board
NASA	National Aeronautics and Space Administration
NCR	Non Conformance Report
NPD	NASA Policy Directive
NPG	NASA Procedures and Guidelines
NPR	NASA Procedural Requirement
NRA	NASA Research Announcement
NRRS	NASA Records Retention Schedules
OPR	Office of Primary Responsibility
OPS	Operations
OTS	Off-the-shelf
PCA	Physical Configuration Audit
PDF	Portable Data Format
PDR	Preliminary Design Review
PIRN	Preliminary Interface Revision Notice
PMO	Program Management Office
RDW	Request for Deviation/Waiver
S&MA	Safety and Mission Assurance
SARG	Space Assurance and Requirements Guideline
SBU	Sensitive But Unclassified
SCaN	Space Communications and Navigation
SDR	Software Defined Radio
SOMD	Space Operations Mission Directorate
SSP	Space Station Program
SSR	Software Specification Review
STRS	Space Telecommunications Radio System
TSC	Telescience Support Center
WBS	Work Breakdown Structure

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APPENDIX B FORMS

B.1 Scope

This appendix lists the CM project forms to be utilized in support of the CoNNeCT project. Electronic versions are available in the GRC CoNNeCT eRoom along with the CoNNeCT Form Master List indicating the authorized forms used for the CoNNeCT Project and their respective version. These project specific forms are additional to any NASA standard forms that may be required.

B.2 Forms Available for Use on CoNNeCT

- Change Request (CR)
- Request for Deviation/Waiver (RDW)
- Document Review Comments Form
- CoNNeCT Control Board Directive
- CCB Summary Form
- Engineering Review Board (ERB)
- Review Item Discrepancy (RID)
- Request For Action (RFA)